

Add-on for Microsoft
Flight Simulator X



DHC-6

Twin Otter
Manual



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Microsoft Flight Simulator X

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Introduction

The DHC-6 Twin Otter has always been one of our most favorite aircraft. Like other aircraft Aerosoft has developed internally, it is one of those aircraft which just seems to keep on flying because no one has ever made an aircraft capable of the same tasks with the same flair and reliability. If you are not a fan of aviation you might not like being a passenger as the aircraft is small, unpressurized and above all noisy. The turbines have a high whine that really gets on your nerve.

But it's the capabilities which are giving the Twin Otter the edge. Try and type in "Twin Otter" on YouTube and you will find some amazing landings and take-offs. In windy conditions the Twin Otter seems to jump into the air as soon the wheels start turning and a runway only seems optional. It flies with skis, floats and wheels and some weird combination of them. In the end the Twin Otter is the ONLY aircraft used by British Airways for the only scheduled daily route to a beach (Glasgow to Isle of Barra, Scottish Outer Hebrides). In 2008 that is nothing short of amazing.



Credits

Concept Project Management: Mathijs Kok

Graphics & models: Dmitry Usatyy, Andrey Tsvirenko
(SibWings lab)

Gauges and Systems: Alex Petrochenko (SibWings lab)
(with assistance from Finn)

Advanced Avionics: Don Kuhn (fs2x.com)

Sounds: Turbine Studios

Flight Models: Stefan Hoffman

Project Management: Mathijs Kok

Manual, documentation: Mathijs Kok

Installer: Andreas Mügge

Additional liveries: Dag Stangeland

Thumbnails: John Cagle

Screenshots: Nick Churchill

Manual Checker: C. Beck

There are many people we need to thanks for the help in this project but two stand out.

- Dave Rees works at Viking Air. He has been assistance from the day one. They are working on a DHC-6 400! How cool is that?
- Finn Jacobsen started as one of beta testers, but soon started to help us with some of the more complex systems. Without any serious knowledge of coding he debugged the whole warning light system and added many functions there.

System Requirements

- Intel Core 2 Duo E6400 (or equivalent)
- Graphics Card that fully supports DX9 with minimally 256 MB memory (512 MB strongly recommended)
- 1 GB RAM (2 GB strongly recommended)
- Mouse with mouse wheel
- 600 Mb of free available SPACE on the hard disk
- Sound card (most preferably one that fully supports DX9)
- Microsoft Flight Simulator X SP1 / SP2
- Windows XP, Windows Vista
- DVD drive (for boxed versions)
- Adobe Acrobat® Reader 8 minimal to read and print the manual (1)

(1) Available for free, download at:

<http://www.adobe.com/prodindex/acrobat/readstep.html>



Support

Support for this product is done by Aerosoft. We prefer to do support on the support forum for one simple reason, it is fast and efficient and because customers help customers when we are sleeping.

Aerosoft forums: <http://forum.aerosoft-shop.com>

We feel strong about support. Buying one of our products gives you the right to waste our time with questions you feel might be silly. They are not. Please note that our online products are supported in English first of all.

English

Models

When we started this project we very soon decided to focus on the 100 and the 300 models and not use the 200 model as it was not build in great numbers. We also decided to offer wheels. Wheel/ski, ski and float models. Amphibian and tundra tires are not included in this product. Both are not very common, the amphibian because the float/wheel combination is heavy and has a lot of drag, both not being good when using an aircraft commercially. For the tundra tires we were simply unable to find the correct information on construction and flight behavior. All these models have different flight models and different performance figures.

100		300	
Wheels		Wheels	
Ski		Wheel/Ski	

Views

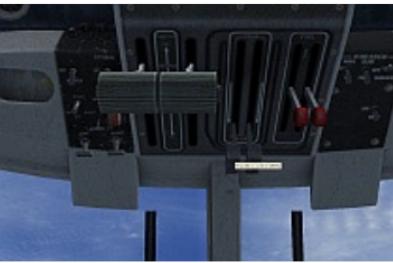
There are no 2d panels included as the VC views in FSX offer the same (if not better) quality and are far more flexible. As with all aircraft select the view mode (Cockpit, Aircraft, Tower, Runway, Outside) with the [S] command and the view inside the view mode [A] command.



Landing Gear



Overhead Front



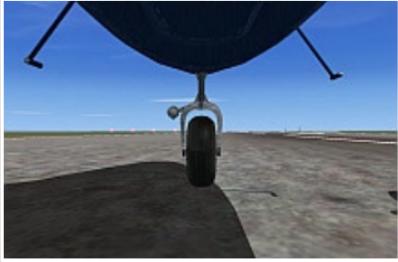
Nose



Overhead Aft



Front Gear



To Cabin



Sight Seeing



From Cabin



Systems Manual

Avionics

The Twin Otter comes with a standard, simply but sturdy and complete navigation and communication package. However as this is rather outdated we also provide a more modern avionics set including a full featured and fully simulated Bendix/King KX165A VHF Nav/Com Transceiver (FSX uses the same radios as default but these are very much simplified) and a Bendix/King 90B GPS Navigation system. Both systems are modeled extremely accurate allowing to use the 'real' manual.

Radar Altimeter



The radar altimeter uses a small radar beam to measure the altitude over the surface. It is far more accurate than any other altimeter and of great use when landing on surfaces like snow and water where it is easy to judge your altitude wrong. The yellow DH light will be on when the altitude is below the decision altitude set by the knob. If used correctly, you should always see the runway when this light is on! Use your mouse wheel to set the bug.



Altimeter



The standard altimeter works on air pressure and needs to be set using the set knob to the actual air pressure. As it is hard to read the small scale this is easier done using the information popping up when you hold the mouse over the setting knob. Use the mouse wheel to set the air pressure. Keep in mind that icing can render this instrument inoperative and use your de-icing when conditions require it!

English

Horizontal Situation Indicator



The HSI combines a lot of different sources of information telling you the heading you are flying and which radial on a navigational beacon you are on. There are two knobs near the lower edge of the instrument, on the left the Heading Bug Knob, on the right the Course Setting. The actual use is well explained in the FSX Help Center. As with other instruments the tool tips you see when the mouse hovers

Horizontal Situation Indicator (Heading 52°, Course 319°)

above the knobs will give the exact

setting. Two flags will indicate that the instrument is not receiving any station or that the instrument is powered down. A more detailed explanation is given by Hal Stoer on his superb web pages;
<http://stoenworks.com/Tutorials/HSI,%20the%20complete.html>

Propeller Panel / Stall Warning

The propeller panel contains the Auto Feather switch and the corresponding indication lights. When set ON the propellers will feather automatically



in flight when the RPM drops too much. This reduces drag. The Beta range lights indicate if the throttles are in Beta range (see the separate chapter in the propulsion systems for more information). The Stall warning will light when stall is detected. Please note that on older aircraft the lights are often dim and the transparent covers not as transparent anymore



Standard Radio Set

The standard avionics consist of two Com tranceivers, two Nav receivers, a dual ADF receiver and a simple transponder. The use of these instruments is exactly as the same instruments in the default FSX aircraft. The click-zones of the instruments is shown in the images below. Note that only the mouse wheel is activated, clicking on the click zones will not work! The simple DME receiver and marker beacon lights complete the simple avionics set.



Note: The NAV 1 receiver is linked to the HSI and the NAV 2 receiver is used for the DME indicator. As FSX can only handle two navigation radios the frequency selector knobs on the DME are not functional.

Advanced Radio Set

Some of the 300 Passenger models are equipped with the more complex and fully realistic transceivers and the advanced GPS system. The operation of these instruments is explained in Appendix C and D, as they are complex instruments they hold many pages of detailed information. Although these instruments can be used in the Virtual Cockpit they can be opened in (the only) 2D mode as well making them easier to read. They can be dragged to a second monitor. Please note these instruments need to be switched off when the engine is started as a possible power spike could damage them.



Oxygen

The oxygen system is not standard equipment and we decided not to add it to our models. The crew oxygen system is ok but the passenger oxygen system is very heavy and affects performance seriously. Certainly at altitudes over 20.000 FT the system will only allow 1,5 hours of operation so the use is limited anyway.



Fuel System

The fuel system of the Twin Otter is simple and reliable. Two Fuel Flow Indicators on the main engine instrument panel show the fuel flow from the tanks to the engines in pounds per hour (PPH).

Fuel storage

The Twin Otter has two main tanks (forward and aft) located in the lower fuselage. Each tank feeds one engine (aft tank feed left engine, forward tank feeds right engine).

The Forward tank contains 1,235 lb (151 Imp. Gal, 181 U.S. Gal)

The Aft tank contains 1,341 lb (164 Imp. Gal, 197 U.S. Gal)

Note the optional wing tanks are not provided.

Fuel pumps

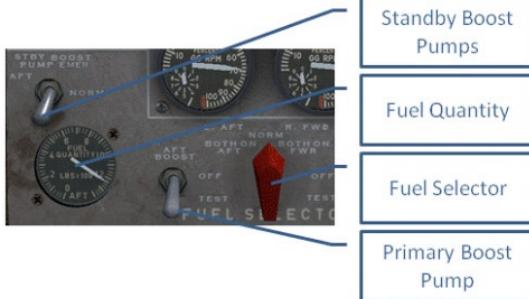
Each tank has a boost pump delivering the fuel under pressure to the engine driven fuel pumps. When the boost pumps fail caution lights will light up. In case the boost pumps fail a backup boost pump system is provided on each tank.

Fuel Selectors

The fuel selector on the center instrument panel has three settings, BOTH ON FWD, NORM, BOTH ON AFT. The NORM setting is the standard setting, the other two settings will open a cross feed valve between the two tanks and will feed both engines from one tank. On the fire panel two Fuel Emergency Switches allow the complete shutdown of the fuel system, closing all valves and shutting down all pumps. These switches are in the NORMAL setting in standard operation.

Fuel Quantity Indication

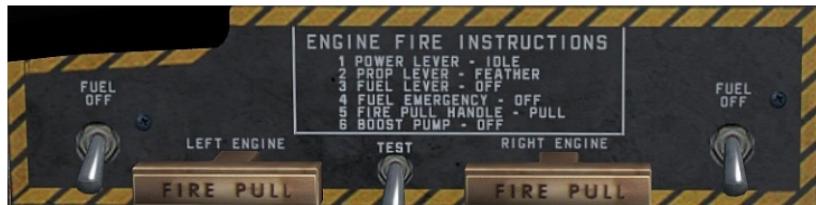
Two Fuel Quantity gauges are installed on the fuselage fuel panel, supported by Fuel Low Level caution lights which will show when 75 pounds remains in a tank.



Fire Protection

The Twin Otter has a simple fire detection system in both engine nacelles. When these detect temperatures the fire pull handle [FIRE PULL] will light up and a warning bell will sound. Pulling the handle will discharge the Freon extinguishing agent. The two fuel cut off switches will shut down the fuel pumps and close the fuel feed lines. The test button is not implemented.

Note: The fire bell mute switch is not simulated as FSX can only simulate engine fires and the use of the extinguishers is always effective.





Ice and rain protection

Although icing is not very well simulated in FSX, the Twin Otter is able to handle all the ice the simulation can throw at you. Do not forget to use the Pitot Heat before anything else as many systems on board depend on the information coming from this pressure source.

A switch right of the Fuel Condition Lever will activate the wind shield wipers. These can be operated at any airspeed.

Lights

Interior lights

Apart from the lights in the passenger compartment (six overhead and individual reading lights) there are two cockpit utility lights and a cockpit dome light (normally on the 300 series but on all our models). White panel lights and eyebrow lights on most gauges assist the pilots. All these lights are linked to the dual instrument light switches which are operated as one switch in our model. The overhead lights in the cockpit (you will need them for the aft overhead panel) can be switched using the [shift][L] command.

Caution Lights

18 individual warning lights are part of the master warning system, not all are simulated, partly because FSX does not know the systems or because they are beyond the scope of system simulation of our project. A test switch on the AFT overhead will light all caution lights.

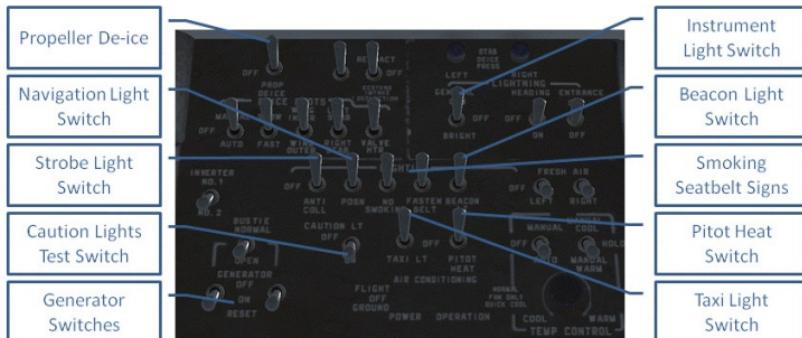
Left/Right Generator	Indicates incorrect voltage or generator being offline	Attempt two resets, when no result switch generator off.
Left/Right Generator Overheat	Not simulated	
Pneumatics Low Press	Indicates deicing and autopilot bleed-air below 14 psi	Shut off heating, increase power to >70%, check bleed air switches.
Reset Props	Indicates propeller levers not at full increase when power is below 75%	Advance propeller to full increase on final approach
Duct Overheat	Not simulated	
Doors Unlocked	Indicates door being open	
Left/Right Oil Pressure	Indicates oil pressure under 40 psi	Shut down engine as soon as possible
400 Cycle	Not simulated	
FWD Fuel Level	Indicates < 75 pound of fuel in forward tank	Check fuel gauges
AFT Fuel Level	Indicates < 110 pound of fuel in aft tank	Check fuel gauges
Boost Pump 1 AFT Press	Indicates fuel boost pressure below 2 PSI and pump is switched off	Automatic change over will activate the secondary pump. When boost pumps on one tank fail, feed both engines from the other tank
Boost Pump 2 AFT Press		
Boost Pump 1 FWD Press		
Boost Pump 2 FWD Press		



Exterior lights

- **Position lights:** The Twin Otter has the standard red/green position lights on the wing tips and a white tail light and is controlled with the [POSN] lighting switch.
 - **Landing lights:** Two 250 watt landing lights are installed on the wings, controlled by the landing light switches. Please note that both the [LANDING LT] switches are activated at the same time.
 - **Anti-collision lights:** Two white strobe lights are located on the wingtips. A red rotating beacon light is located on the top of the vertical stabilizer. The white strobe lights are controlled by the [ANTI COL] switch, The red rotating beacon is controlled by the [BEACON] switch.
 - **Taxi lights:** Not a standard equipment, the 100 watt taxi light is located on the left side of the nosewheel fork and is controlled with the [TAXI LT] switch.
 - **Logo Lights:** The optional logo lights are installed on the upper surface of the stabilizers and will illuminate the sides of the vertical stabilizer.

None of our models has the optional wing inspection lights installed.



Hydraulics

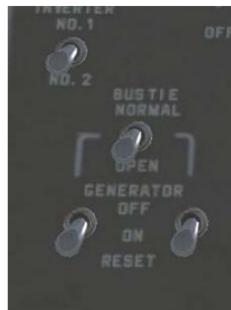
Hydraulic pressure on the Twin Otter is provided by an electrical constant volume pump running from the left electrical bus while the complete system is fully automated. There are no controls of any kind in the cockpit. Nose wheel steering, flaps and wheel brakes are operated hydraulically.

There are two gauges that show hydraulic pressure, the system pressure indicator and the brake pressure indicator. Both will show identical pressure, only when there is a system pressure failure the brake pressure indicator will show the remaining pressure retained for braking.

Note: A manual pump is provided as backup, using a long metal lever which is inserted into the pump located under a cover on the cockpit floor, directly left of the control column. Although the result of this manual pump is simulated the actual action of pumping is not. By clicking the mouse on the manual pump door cover hydraulic pressure will be restored to normal values, this action does not have to be repeated.

Electrical Power

The Twin Otter has a 28 volts DC single wire electrical system that uses the airframe as ground return. There are three sources: (main 40 amps battery,, two starter/generators and an option to use 28 VDC external power. Two inverters convert the DC power to ACD power for the avionics. The two engine driven generators are the main power source and also serve as starter motors. Each generator feeds its own bus (left/right) and the auxiliary bus is connected to the left bus. The generator switches activate or deactivate the engine driven generators. The RESET position is not simulated. The avionics systems are protected from power surges behind the avionics master switch, located on the front overhead.





Note: The Inverter and Tie switch is not simulated due to limitations in the electrical modeling of FSX. In our model AC power is always available if any of the generators is running or the battery remains charged.

Volt and Load indicators



The Volt indicator shows the current voltage of the battery or the voltage the generators deliver. The Load indicator shows if the battery is charging or de-charging and if the

generators are providing a loading charge to the systems. With the generators off you will see a negative load on the battery. The three way switch allows the monitoring of the two generators and the battery.

The DC master switch (left of the power levers) connects or disconnects the battery to the busses.

Note: The Battery Temperature Monitoring System is not simulated because FSX does not contain any parameters to feed the system in a reliable way. Battery temperature is caused by many factors and the real system is normally totally reliable.

Landing Gear

The Twin Otter landing gear consists of two fixed main gear assemblies and a fixed steerable nose gear assembly. The main gear uses urethane (like rubber) blocks to absorb the shock of the landing. This is a very robust and sturdy system that is very useful for a STOL aircraft but it does lack some of the comfort of a coil shock absorber assembly. The nose gear has a conventional air-oil shock strut system.

Note: The nosewheel steering is rather special as it uses a lever mounted behind the pilot's control yoke to control a hydraulic steering system. We did experiment with simulating this. But it proved very hard to control the steering using a mouse to control a lever that is partly hidden from view so we decided to fall back to a better known rudder control system.

Oil System

The Twin Otter oil system is a fully automatic, self-contained system providing cooling and lubrication for the complete engine. In addition it also provides the pressure for the propeller control and the torque meter and heats the fuel through an oil-to-fuel heat exchanger.

Oil pressure and oil temperature is measured in the pump outlet line and send to gauges on the instrument panel. A low oil condition is also indicated by Low Oil Pressure caution lights.

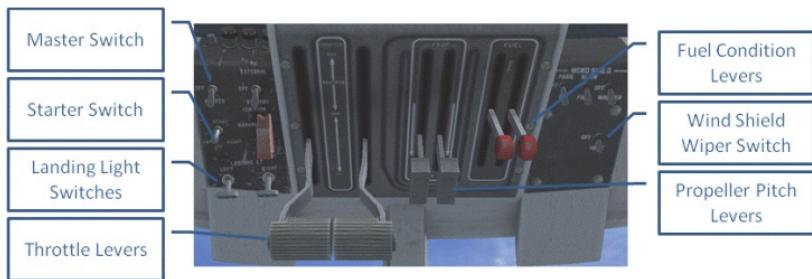
Powerplant

The Twin Otter airplanes are powered by wing-mounted PT6A turboprop engines constructed by Pratt and Whitney. These light weight gas turbine feature twin independent turbines which are only aerodynamically coupled. The first stage (compressor) drives the gas generator section while the second turbine drives the propellers through a reduction gearbox. It might surprise you that air is actually entering the engine at the back and exhausts at the front. Inside the engine the airflow reverses three times. Although more complex than a straight jet engine the PT6A is highly reliable as long as temperatures are controlled. Any operation in the beta ranges cause the engine to heat up and should be monitored.



Engine controls

The main engine controls are located on the center overhead panel.



Fuel Levers

The fuel condition levers have two positions, ON and OFF and simply control fuel shutoff valves. Please note the levers move a long way but they actually only have two settings, OFF when pulled fully back and ON in any other setting.

Propeller levers

The propeller RPM levers control the propeller blade angle between FEATHER and full INCREASE.

Power Levers

Incorrectly labeled THROTTLE this power lever controls the fuel flow to the engines. There are two ranges combined in the control, MAX to IDLE and IDLE to REVERSE. The MAX to IDLE range controls the engine between full power and idle. Moving the power levers beyond the IDLE setting to REVERSE allow the engine to drive the propellers so thrust is reversed. This allows the aircraft to taxi backwards or reduce speed.

The power lever range goes from full reverse through ground idle (GI) to flight idle (FI) and then on up to full power. Below FI you are

operating in the beta range where the PL position (unless the CL is in feather or you feather manually) directly controls the prop pitch from -16.5 to +10 degrees. Above FL there is a minimum pitch stop ranging from +10 (FL) to +25 (full power degrees pitch. As you go from PL full aft to PL full forward, more and more fuel is added to the engine (naturally) through signals to the Hydro-Mechanical Unit (HMU). At low power settings (below approx 30%), this amount of fuel is not enough to spin the propeller up to the commanded 1180 RPM at the pitch setting commanded by PL in beta range or at the minimum pitch stop.

Beta modes allows much faster control of the thrust. Due to the slow response to throttle setting changes in turbo engines it is very impractical to use the throttle to control movement on the ground. You would have to wait for the gas generator to spin up (Ng increase), providing more torque through the power turbine (PT) increasing the prop RPM (N_p). The prop CS governor would then tell the pitch control unit (PCU) to increase the prop pitch and then you would get additional power. In beta mode, you change the pitch first instead using the inertia in the propeller system to provide thrust, letting the Ng accelerate or decelerate in response to N_p to keep N_p constant.

Note: Because they are mounted overhead the mouse controls are inverted, so dragging the mouse forwards will move the lever backwards.

Propeller

The Hartzell all-metal three-blade, single-acting, constant-speed units is a major key to the short runway capability of the Twin Otter. It offers full feathering (to reduce drag) and full reversing (to reverse thrust) capabilities. Normally the propeller will automatically feather when the engine is shut down and will un-feather as the engine spools up to idle RPM.



Powerplant instrumentation

All engine gauges are installed on the center instrument panel.

Torque Pressure

The main thrust indicator as it shows the portion of total thrust to the propeller. This gauge requires 26 volts to operate. It is your primary thrust indicator as it indicates how much of the total power is delivered to the propeller.

Propeller RPM

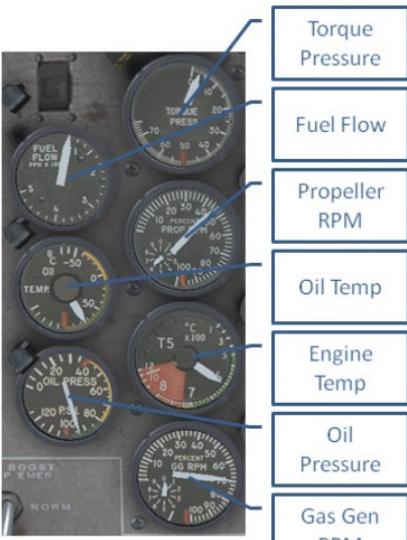
This mechanical gauge (does not require electrical power) indicates the revolution per minute of the propeller. It indicates in percentage of maximum RPM (around 2200).

Engine Temperature (T_5)

Engine temperature is measured at 8 locations in the gas stream between the gas generator turbine and the power turbine. An average of the temperature is send to the instrument panel and the gauge requires 26 volts to operate.

Gas Generator RPM (N_g)

Gas Generator RPM is measured at the accessory gear and is send to the instrument panel in percentage of maximum design RPM.



Oil Pressure / Oil Temperature

See Oil System section.

Fuel Flow

See Fuel section.

Trim



Like most aircraft the Twin Otter has 3 axis trim controls. These are electrical and operated by controls mounted on the seats of both pilots. Use your mouse wheel to change the settings. When you keep your mouse pointer on the control a tool help will pop up showing the exact setting.

Outside Air Temperature



OAT is very important for your takeoff as the air temperature determines to some degree how much runway you will need. The indicator is mounted on the roof, and is unfortunately rather influenced by direct sunlight. So when the sun has been shining on the aircraft for a few hours the indication will be higher than the actual temperature.



Flaps

The hydraulically operated wing flaps consist of inboard and outboard fore flaps and an inboard trailing flap on each wing. There are indications on both the flap levers and on the windshield center post. Note that the flaps actually have a range between 0 and 37.5° and not 40° as the scales indicate. Like many other controls they are operated with the mouse wheel (or with the standard FSX keyboard controls).

To counter pitch movements on flaps extension and retraction the flaps are linked mechanically to the trim system. Although effective this will not fully remove pitch effects.

Operational Manual

The Twin Otter is designed to be used in many different roles. It is equally suited to get people from major airports to smaller airports as it is suitable to fly supplies to a small field somewhere far from civilization. What sets it apart from other aircraft is the STOL capability, the ability to land and depart from very short and often unpaved runways.

In flight the Twin Otter is a docile and rather easy to handle aircraft. The engines have enough power (like most twins) to get you out of problems, although the slow spin-up of the turbines is an issue. Being a high wing aircraft the initial stability is excellent and the flaps systems allow a great range of possible airspeeds.

The use of the beta range or even reverse range of props and throttles in flight is certainly not advised, but it is well known that the aircraft used to take sky jumpers to altitude just wing over and go vertical to get to the ground as fast as possible. The only way to avoid over speeding in that situation is to use the reversed thrust. As said not advised, but certainly done and great fun.

Standard wheeled operation

The Twin Otter is unremarkable in standard ground operation, in fact most of its design characteristics make the aircraft easy to handle. The engines are high up on the wings making ingestion of objects less likely, the undercarriage is very wide and very stable, the low pressure tires make driving over rough terrain easy and the smooth and quick reacting throttle propeller settings allow a great deal of control with the engines. They are also a smooth backwards taxi and there you find one of the problems. Don't even think about using the brakes while going backwards, you will end up with your rudder on the ground looking towards the sky. Only use engine controls to come to a complete stop before using the wheel brakes.

Water operations

The Twin Otter is not very hard to maneuver in the water in real life but in FSX it is harder if you do not have dual throttle controls. There are no water rudders and most of the directional controls is done with the throttles. If you really like to fly turbine twins the use of a more advanced throttle quadrant like the CH throttle is a sound investment.



Turn/maneuver in high wind conditions

In windy conditions, if you need to move in any direction other than into the wind, you can use the aircraft as a sailboat. Let the floatplane weathercock into the wind, then - with the engine at idle - let the wind blow you backwards. You can lower the flaps to increase the area affected by the wind. It is actually rather much fun to fully control this.



To sail backwards to the left:

- Retract the water rudders.
- Press the right rudder pedal.
- Move the yoke all the way to the left.

To sail backwards to the right:

- Retract the water rudders.
- Press the left rudder pedal.
- Move the yoke all the way to the right.

To sail sideways across the wind

- Use slight engine power to prevent the floatplane from drifting backward.
- Point the nose a few degrees in the direction you want to go. The wind will strike only one side of the fuselage and push the plane sideways.

Taxi

There are three ways to taxi;

1. Displacement taxi where you keep your speed down, your water rudders in the water (note you steer with the rudders at that moment). The aircraft behaves like a boat. You keep the stick all the way back to keep the propeller as high as possible (water will damage the prop). If there is a strong wind from behind you keep the stick fully forward! If there is moderate or strong wind you use your ailerons to prevent capsizing. The rule is simple; keep the yoke into the wind (wind from left, yoke to left)
2. Plowing taxi where you apply some more power and the nose of the floats will be raised (keep the stick back). This will help you turn. Small burst of power, with full rudder will make you turn really fast.

3. Step taxi is just like being in a powerboat. On the initial takeoff run when you first add full power, you are holding the stick back in your lap. Once the nose doesn't rise any higher, you relax the backpressure and let the nose start to „settle” into a more level attitude. As it comes onto the step, you are not plowing nearly so much through the water but rather starting to ride up on top of it, so your acceleration starts to increase quite dramatically. Once on the step you need to hold a tad of backpressure on the stick to keep the nose of the floats from digging in, but with practice, you really get a „feel” for where the exact correct attitude is. Relax backpressure a bit too much and you'll feel the nose starting to dig in a bit, and hold a bit too much pressure and the heels will dig in a bit (much safer than the former, but will slow your takeoff run just as much). When the attitude is exactly right, only the 1/3 portion of the float from the step forward is in the water. The bows and sterns of the floats are out of it (although it's pretty hard to see that when beside the aircraft due to the spray). Now, if you are light, the step comes easy and fast, and is easy to hold. When heavy, it's much slower getting onto the step, and there is a much more gradual transition to the step. This is because there is more float sitting in the water for a longer period of time until the wing develops enough lift to actually get the float fully on the step. (thanks to Glenn!)

Takeoff

1. Do your run-up and pre-takeoff checklists.
2. Select the lane you are going to use and make sure it is clear of traffic or floating objects.
3. Lower the flaps to takeoff setting.
4. Get 'on the step' (see the taxi procedures for this).
5. Apply takeoff power
6. Right after liftoff lower the nose to gain some speed.



Landing

1. Do your pre-landing checklist.
2. Scan your landing area carefully, warn boats and swimmers by flying low in both directions over the lane you intend to land on.
3. Fly a standard traffic pattern
4. On final check the altitude by looking at the shoreline.
5. Do not perform a power off landing because it is not easy to judge your actual altitude.
6. The moment the floats touch the water, gently pull the stick to counter the sudden drag that wants to pull the nose down. Make sure the tip of the floats stays below the water surface, when it does at higher speeds you might end up floating upside down.

Ski operations

Although ski operations are a lot like normal wheel operations the most obvious differences is that you lack the strong wheel brakes or the strong drag of the floats in the water. So you need to plan for that. There is also less directional control and when the snow is iced over your aircraft can start to behave as if it were on floats. As snow operations are often done at higher altitude, density altitude becomes a serious factor (although the inherent low temperatures do help).

Failures and Emergencies

One of the best features of FSX is the extended failure mode. The Twin Otter has been designed to use this feature fully. From catastrophic engine failures to a minor failure of a radio receiver. We strongly advise you to set up some random failures to spice up your life. Take a moment to read the help files of FSX about the failures and then decide how exiting your flights should be. Below you see the results of an engine fire on the runway, we are just about to pull the fire levers to get this fire out.



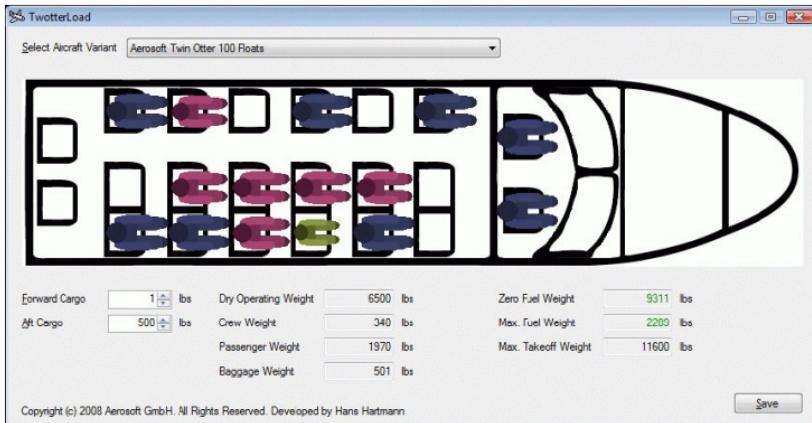
Engine out gliding

Due to the STOL capabilities and the reasonably good aerodynamics the Twin Otter has a good glide angle at speeds around 80 to 90 knots (with both propellers feathered). The fact the aircraft is maneuverable and can land on a very short runway or unprepared surface will help you in this situation.



Load Module

Hans Hartmann build a fine load module for the Twin Otter. You will find it via the Start Menu (Aerosoft – Twin Otter). The use is very simple, select the aircraft and click on the seat to toggle between no passenger, child, small person, large person. Then save the aircraft and start FSX. The cargo version has no graphics to click on, just fill in what's loaded.



Please note the change in the load does not reflect what you will see in the simulator. Also note the load module uses the maximum 20 person commuter layout, while we are using a 17 passenger layout because that looked better in FSX.

Appendix A

DHC-6 Twin Otter Standard Operational procedures

*) text in grey shows items that not are simulated in the Aerosoft Twin Otter

Preflight

<input type="checkbox"/> Preflight inspection	Complete
<input type="checkbox"/> Passenger briefing	Complete

Before starting check

<input type="checkbox"/> Parking brake	Set
<input type="checkbox"/> Fire T-handles	In
<input type="checkbox"/> Standby fuel pumps	Normal
<input type="checkbox"/> Fuel selector	Normal
<input type="checkbox"/> Fuel boost pumps	Off
<input type="checkbox"/> Static source	Normal
<input type="checkbox"/> Avionics Mastr	Off
<input type="checkbox"/> Vent fan	Off
<input type="checkbox"/> Radio circuit breakers	Checked
<input type="checkbox"/> Main panel circuit breakers	Checked
<input type="checkbox"/> Inverter switch	Select 1 or 2
<input type="checkbox"/> Deicing switches	Off
<input type="checkbox"/> Propeller de-ice	Off
<input type="checkbox"/> Cabin light and signs	Set
<input type="checkbox"/> Beacon light	On
<input type="checkbox"/> Bleed air switches	Off
<input type="checkbox"/> Pitot heat	Off
<input type="checkbox"/> Generator switches	Off
<input type="checkbox"/> Bustie switch	Normal
<input type="checkbox"/> Flap handle	Up



[] Fuel levers	Off
[] Propeller levers	Full forward
[] Power levers	Flight idle (throttles appr10% forward)
[] Windshield heat	Off
[] Windshield wipers	Off
[] Landing lights	Off
[] Ignition switch	Normal
[] Battery master	On
[] Bus voltage	Check
[] Caution lights	Test & Checked
[] Marker beacon lights	Press to Test
[] Beta lights	Press to Test
[] Fire detection	Test
[] Fuel quantity	Checked
[] boost pumps	AFT and FWD On
[] Crossfeed check	(check caution light panel):

Fuel selector: Both on FWD -> Boost pump P1 AFT	On
Boost pump P2 AFT	On
Boost pump P2 FWD	Off
Boost pump P1 FWD	Off

Fuel selector: Both on AFT -> Boost pump P1 AFT	Off
Boost pump P2 AFT	Off
Boost pump P2 FWD	On
Boost pump P1 FWD	On

Fuel selector: Normal	-> Boost pump P1 AFT	Off
	Boost pump P2 AFT	Off
	Boost pump P2 FWD	Off
	Boost pump P1 FWD	Off

- Fuel boost pumps Off
- Stdby fuel pump check (check caution light panel):

Stdby fuel pump AFT:	EMER ->Boost pump P1 AFT	On
	Boost pump P2 AFT	Off
	Boost pump P2 FWD	On
	Boost pump P1 FWD	On

Stdby fuel pump FWD: EMER ->Boost pump P1 AFT	On
Boost pump P2 AFT	On
Boost pump P2 FWD	Off
Boost pump P1 FWD	On
[] Fuel boost pumps	On
[] Brake / Hydraulic pressure	Check

Engine Start (Start right engine first, then left)

[] Fuel boost pumps	On, Lights out
[] Engine start switch	Engage
[] Oil pressure	Check rising
[] Ng	Check stabilized
[] Fuel lever	On (full forward)
[] T5 and Ng gauges	Monitor
[] Engine start switch	Back to center position

Repeat for Left engine

After start checks

[] Power levers	Idle
[] Generators	On
[] Generators voltages and loads	Check
[] Engine instruments	Check stable and within limits
[] Compass and Gyro instruments	Check
[] Caution lights	Appropriate
[] Altimeters and clocks	Set
[] Anti Coll and position lights	On

Taxi checks

[] Brakes	Check
[] Nose wheel steering	Check
[] Gyros and turn needles	Check



Run-up Checks:

[] Parking brake	Set
[] Propeller levers	Pull to feathered position
[] RESET PROPS Caution light	On
[] Propeller levers	Full forward
[] Power levers	Retard from flight idle until left and right Beta range lights comes on, then to flight idle(throttles appr 10% forward until Beta range lights are off)
[] Beta backup	Test
[] Propeller overspeed	Test
[] Auto feather	On/Arm
[] Auto feather	Test
[] Anti ice	As required

Before take-off checks

[] Trim tabs	Set
[] Flaps	Set 10°
[] Flight instruments	Check
[] NAV / COM radios	Set
[] Propeller levers	Full forward
[] Auto feather	On (SEL light on)
[] Engine instruments	Check
[] Bleed air	As required (On)
[] Anti ice	As required

Line-up checks

[] Flight controls	Free / Full travel
[] Transponder	Set and On
[] Landing lights	On
[] Caution lights	Appropriate
[] Runway and heading	Check

After take-off checks

[] Flaps	Up
[] Auto feather	Off
[] Climb power	Set
[] Nose wheel steering	Centered
[] Landing lights	Off

Cruise checks

[] Cruise power	Set
------------------	-----

Descent checks

[] Fuel quantity / selector	Checked / Normal
[] Brake / Hydraulic pressure	Check
[] Caution lights	Appropriate
[] Anti ice	As required
[] Altimeters	Set
[] Signs	Set
[] Landing lights	On

Before landing checks

[] Nose wheel steering	Centered
[] Flaps Set	as required
[] Propeller levers	Full forward

After landing checks

[] Flaps	Up
[] Bleedair	Off
[] Anti ice	Off
[] Landing lights	Off
[] Transponder	Off
[] All Trim tabs	Reset to neutral



Shut-down checks

- | | |
|----------------------------|---|
| [] Parking brake | Set |
| [] Power levers | Flight idle (throttles appr. 10% forward) |
| [] Propeller levers | Feathered position |
| [] Generators | Off |
| [] Fuel levers | Off |
| [] Fuel boost pumps | Off |
| [] All light switches | Off |
| [] Battery master | Off |
| [] Last flight of the day | If yes, take beer |

Appendix B KX 165A TSO



Design & Copyrights of gauge, graphics and manual Don Kuhn



www.FS2X.com

Part of Aerosoft DHC-6 Twin Otter X
Manual changes Mathijs Kok (Aerosoft)
Graphic alternations Mathijs Kok (Aerosoft)

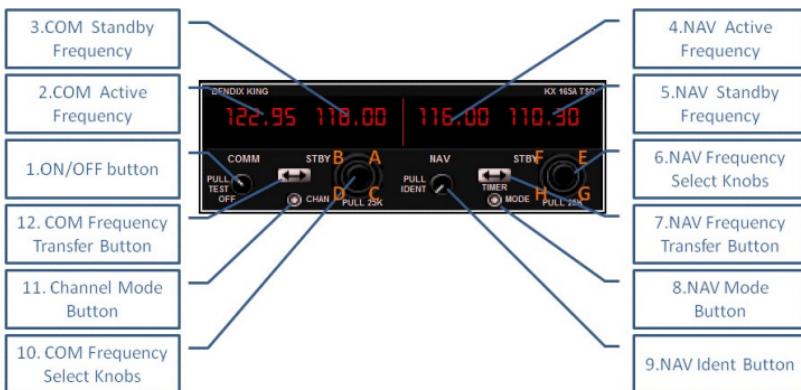


Introduction

The KX 165A Transceiver is a communication and navigation radio. Two frequencies, active and standby, are available for both communications and navigation. Frequencies are typically entered into the standby frequency, and then exchanged with the active frequency to become active by using the COM or NAV FREQUENCY TRANSFER BUTTONS. There is also a „direct tune“ mode which allows the user to change either the Com or Nav active frequencies directly. There is a PAGE mode and a CHANNEL mode for communications that allows the user to store up to 6 Com frequencies which can be exchanged directly with the active frequency at the click of a button. In addition, OBS, bearing-to, radial-from, count-up and count-down timer modes are available for navigation.

All of the controls for the radio are located on the front of the radio. The displays and controls for the communication functions are presented on the left side of the unit, the displays and controls for the navigation functions are on the right side. Communication controls include the COM FREQUENCY TRANSFER BUTTON, the CHANNEL MODE BUTTON, and the COM FREQUENCY SELECT KNOBS. Navigation controls include the NAV FREQUENCY TRANSFER BUTTON, the NAV MODE BUTTON, and the NAV FREQUENCY TRANSFER BUTTONS. All of the communications functions, excluding the display of the active frequency, are displayed at the location of the COM STANDBY FREQUENCY. Similarly, all navigation functions are displayed at the location of the NAV STANDBY FREQUENCY.

Overview



- 1. ON/OFF BUTTON:** Powers the unit on and off.
- 2. COM ACTIVE FREQUENCY:** Digital display of the active communications frequency.
- 3. COM STANDBY FREQUENCY:** Digital display of the standby communications frequency.
- 4. NAV ACTIVE FREQUENCY:** Digital display of the active navigation frequency.
- 5. NAV STANDBY FREQUENCY:** Digital display of the standby navigation frequency.
- 6. NAV FREQUENCY SELECT KNOBS:** An outer and an inner knob. The outer knob increments/decrements the navigation frequency in 1 MHz steps, and the inner button increments/decrements in 50 kHz steps. The outer knob is increased by clicking on the letter E at the upper right side of the knob and decreased by clicking on the letter F at the left. The inner knob is increased by clicking on the letter G at the bottom right, and decreased by clicking on the letter H at the bottom left. The NAV FREQUENCY SELECT KNOBs are also used to enter count-down values in the count-down mode. The outer knob increments/decrements the time in 1 minute steps. The inner knob increments/decrements time in 1 second steps. Click spots



are the same as above. The NAV FREQUENCY SELECT INNER KNOB has 2 positions, an out and an in position. Clicking directly on the button will toggle between these 2 positions. The out position is the default position. Functions requiring the out position include entry into the direct tune mode, active and standby Nav frequencies exchange in the OBS, bearing, and radial modes, resetting the count-up timer, and entering and exiting the count-down timer mode. Functions requiring the in position include active and standby Nav frequencies exchange in the default screen, direct active frequency change in the OBS, bearing and radial modes, and entering data, stopping, and resetting the count-down timer.

7. **NAV FREQUENCY TRANSFER BUTTON:** This button is used primarily to exchange the active and standby navigation frequencies. In the default screen the NAV FREQUENCY SELECT INNER KNOB must be in the „in“ position, and in the „out“ position in the OBS, bearing, and radial modes for the exchange to occur. This button is used to enter the direct tune mode, to reset the count-up timer, and to stop and/or reset the count-down timer. It is also used to enter and exit the count-down timer mode.
8. **NAV MODE BUTTON:** Used to sequentially step through the different navigation screens. Clicking the button at the last screen will „wrap around“ to open the default screen.
9. **NAV IDENT BUTTON:** Turns on Nav IDENT when toggled to the out position. The corresponding Nav “on” annunciator on the GMA 340 will illuminate.
10. **COM FREQUENCY SELECT KNOBS:** An outer and an inner knob. The outer knob increments/decrements the communications frequency in 1 MHz steps, and the inner button increments/ decrements in 25 kHz steps. The outer knob is increased by clicking on the letter A at the upper right side of the knob and decreased by clicking on the letter B at the left. The inner knob is increased by clicking on the letter C at the bottom right, and decreased by clicking on the letter D at the bottom left. The COM FREQUENCY SELECT KNOBs are also used to enter

frequency values in the direct tune and page modes. The knobs increment/decrement the values as discussed above. The inner, kHz knob, is also used to step through the pages and channels of the page and channel modes, respectively.

- 11. CHANNEL MODE BUTTON:** Used to enter and exit the page and channel modes.
- 12. COM FREQUENCY TRANSFER BUTTON:** This button is used primarily to exchange the active and standby communications frequencies. No other buttons are required for the exchange. This button is also used to enter the direct tune mode, and to allow the entering of frequencies in the page mode.

Power

Power the unit on by clicking the ON/OFF BUTTON. Make sure it is OFF when the engines are started.

Setting frequencies

Set Com and Nav frequencies using the COM- and NAV- FREQUENCY SELECT KNOBS, respectively. The active frequencies can be entered in two ways:

1. Dial the desired number in as the standby frequency and then click on the COM or NAV FREQUENCY EXCHANGE BUTTON to place the entered number into the active frequency, (**note: the NAV FREQUENCY SELECT KNOB must be in the „in“ position to exchange the Nav frequencies**),
2. Hold the COM or NAV FREQUENCY EXCHANGE BUTTON down longer than 2 seconds and enter the value directly into active frequency (direct tune). The standby frequency is not displayed in the direct tune mode. Click the exchange button again to exit the direct tune mode. The standby frequencies can be entered directly using the appropriate knobs.



Storing frequencies

Enter Com frequencies into storage for later easy retrieval, up to 6 frequencies can be stored. The frequencies are entered in the PAGE mode. To enter the PAGE mode, hold the CHANNEL MODE BUTTON down for longer than 2 seconds.

There is a „PG *” (* denotes page number) annunciation to show you are in the PAGE MODE, and at this time a semitransparent rectangle behind the annunciation. There are now 2 choices:

1. Click on the COM FREQUENCY EXCHANGE BUTTON to enter numbers using the COM FREQUENCY SELECT KNOB. In this data entry state the rectangle behind the PG * annunciation will disappear and a larger rectangle will appear behind the frequency numbers. Click again on the COM FREQUENCY EXCHANGE BUTTON to exit the entry state, the large rectangle will disappear and the smaller rectangle behind the PG * annunciations will reappear.
2. Sequentially step up or down through the different pages in the PAGE mode by clicking on the inner, kHz, knob (letters C and D in the above picture). Click on the CHANNEL MODE BUTTON to exit the PAGE mode.

Numbers are entered into the specific pages by going to that page, and then entering them as discussed above. You cannot change pages when in the data entry state. The PG * annunciation and the rectangle behind it indicates that you are in the PAGE mode and that you can step through the pages. The rectangle behind the frequency, and the PG * annunciation, shows you are in the data entry state of the PAGE mode. Clicking on the CHANNEL MODE BUTTON while in the PAGE mode data entry state will take you directly to the CHANNEL mode, clicking on the CHANNEL MODE BUTTON again takes you back to the default screen and enters the number into the standby frequency.

Retrieving frequencies

When desired, the stored frequencies can be retrieved and placed into the active frequency by going into the CHANNEL mode. This is done by clicking on the CHANNEL MODE BUTTON for less than 2 seconds. A „CH *“ annunciation will appear with a semitransparent rectangle behind it to show you are in the CHANNEL mode. The number displayed is the CHANNEL mode number and corresponds directly to a specific PAGE mode number.

Use the inner, kHz, COM FREQUENCY SELECT KNOB (click spots C and D) to step sequentially through the channel pages. You can now enter that number into the standby frequency by clicking again on the CHANNEL MODE BUTTON and then entering it as the active frequency by clicking on the COM FREQUENCY EXCHANGE BUTTON. Clicking on the CHANNEL MODE BUTTON will also take you out of the CHANNEL mode back to the default screen.

Navigation pages

The different NAV pages can be sequentially viewed using the NAV MODE BUTTON. Each click of the button steps the display to the next page, and the last click recycles the pages back to the first page. The active Nav frequency can be directly changed in the OBS, BEARING, RADIAL, and Timer pages by clicking on the NAV FREQUENCY SELECT KNOB and then using the knob to enter the new value. When entering data there is a rectangle behind the active frequency to indicate you are in the data entry state. The active frequency can be exchanged in these pages by clicking the NAV FREQUENCY EXCHANGE BUTTON.



Navigation OBS page

In the default page, click the NAV MODE BUTTON once to get to the OBS page. The OBS page displays a typical CDI with a needle that shifts left or right depending on the relative position of the aircraft to a received signal. Centering the CDI needle using the EFIS CONTROL PANEL will also center the needle in the KX 165A. A TO or FROM annunciation will be displayed in the center of the CDI scale if a DME signal is being tracked.

Also, the direction to the signal will be displayed in the standby frequency location. A dashed horizontal line and the word FLAG is displayed if no signal is received. If the signal is from a localizer, the direction annunciation is replaced by the letters LOC.

Naviagtion bearing page

Click on the NAV MODE BUTTON once again to get to the BEARING page. This page displays the bearing to or from a received signal station. The value is in degrees magnetic north. When tracking to a station the letters TO will be annunciated.

Navigation radial page

Clicking the NAV MODE BUTTON again brings up the RADIAL page. The radial page displays the radial in degrees magnetic north from the station. The letters FR will be annunciated to show that tracking is occurring.

Timer page

Click the NAV MODE BUTTON again to get to the timer page. The timer is displayed in a min:sec format. The default page shows the count-up timer. If the timer has not been reset, the time shown will be the time passed from when the unit was powered up. The count-up timer can be reset to 0 by clicking on the NAV FREQUENCY EXCHANGE BUTTON. Depressing the NAV FREQUENCY EXCHANGE BUTTON for longer than 2 seconds when the NAV FREQUENCY SELECT KNOB is in the out position will stop the count-up timer and bring up the count-down timer.

When entering this page, there is a rectangle over the time display showing the readiness to enter a value to count down from. Enter the value desired using the NAV FREQUENCY SELECT KNOB. (**note:** the NAV FREQUENCY SELECT KNOB must be in the out position to enter data into the count-down timer, else the knob will be used to change the active frequency). Click on the NAV FREQUENCY CHANGE BUTTON to start the countdown. When the count-down has started, clicking on the NAV FREQUENCY SELECT KNOB will reset the value back to the value entered. The count-down timer is stopped by clicking on the NAV EXCHANGE BUTTON again. To exit the count-down timer page and return to the count-up timer page, hold down the FREQUENCY EXCHANGE BUTTON for longer than 2 seconds.

Clicking the NAV MODE BUTTON again will get you back to the main Nav page.

Appendix B KLN-90B User Manual





Introduction

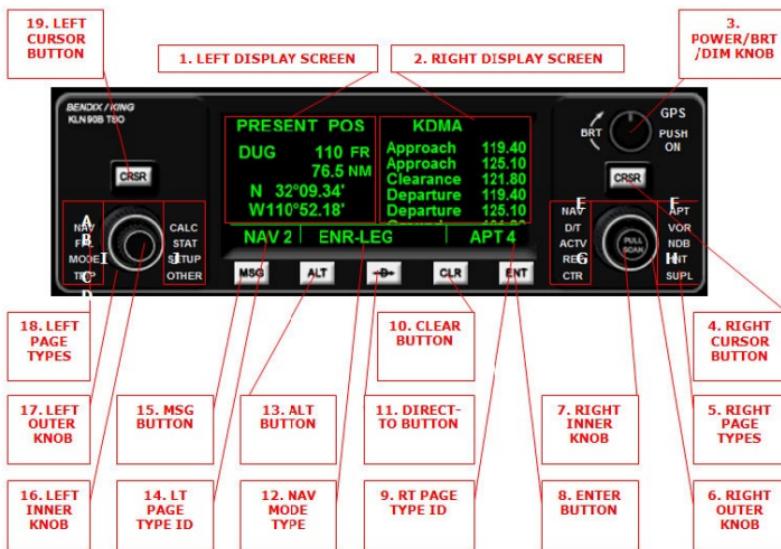
Although not state of the art when we release the Aerosoft Twin Otter X, the KLN-90B is one of the most used navigation systems in aircraft the size of the Twin Otter. The main reason is that it is a very easy replacement, it fits in the avionics bay, all the connections are available and you can pick up a copy for a very reasonable price. And for that price you get a whopping load of information, not only a solid database of navaids, waypoints and airports but also the answer to just about any calculation you might need.

The problem is that the KLN-90B is small. It has few knobs and a small screen. So everything has many functions or is shown in abbreviated text. Yet the interface is logical and when you know one function you understand the next a lot faster. It's a steep learning curve that ends on a smooth platform where just about everything you need is displayed and connected to your aircraft. You need to invest a few hours to really learn to use it. But the people at Bendix/King are the kings (pun intended) of avionics and the KLN-90B sold many tens of thousands of copies and is still in high demand. If you know how to use it you can do exactly the same as the pilots who fly the latest glass cockpits. In fact you can do it better under the conditions the Twin Otter is designed for. It would not be the first time a modern aircraft was started up somewhere on an ice plateau to find out that the large LCD displays simply do not work at -24 Celsius. You are flying a Twin Otter. As long as you can stand it the aircraft will.

Aerosoft licensed these gauges from Don Kuhn. He is a friend by now.

Mathijs Kok
Aerosoft Concepts & Developments

Overview



The KLN 90B GPS Navigation System contains a wealth of aeronautical information. This information is presented on the display screen in the form of „pages“. Each page contains specific and related information presented in a specific format. Related information pages are grouped into 17 page „types“, and most are further divided into related sub-groups to give over 50 different information pages. The information contained in these pages includes fuel and air data, lateral and vertical navigation, unit conversions, flight and trip planning, and direct-to navigation, to name a few. In addition, there are 9 pages each of the nearest airports, VORs, and NDBs. A zoomable, moving map is also presented as a page.



Definitions

1. **LEFT DISPLAY SCREEN:** Displays the current left group page information.
2. **RIGHT DISPLAY SCREEN:** Displays the current right group page information.
3. **POWER/BRT/DIM KNOB:** Used to turn the unit on and off, and to adjust screen brightness. Click on the knob to turn power on/off. Click to the right of the knob to increase screen brightness, and to the left to decrease it.
4. **RIGHT CURSOR BUTTON:** Initializes data entry mode to allow data entry into the right group pages. A background rectangle highlights the value to be changed. Except for the right NAV type page, the RIGHT INNER KNOB must be „in” for this button to function. Also used to exit the data entry mode. The letters CRSR are displayed in place of the page type name and number when the cursor function is on.
5. **RIGHT PAGE TYPES:** Lists the 10 page types available in the right group. Scroll forward or backwards through the list using the RIGHT OUTER KNOB.
6. **RIGHT OUTER KNOB:** Primary function is to scroll forward and backward through the right group page types. The RIGHT INNER KNOB must be in the default „out” position. Also used to scroll through highlighted fields when the RIGHT INNER KNOB is „in” and the RIGHT CURSOR BUTTON function is on. Click on the letter E to go backwards, and on the letter F to go forward.
7. **RIGHT INNER KNOB:** Primary function is to scroll forward and backward through the right group page type sub-pages. The knob must be in the default „out” position. Also used to scroll through highlighted fields and, in some cases, enter data when it is pushed „in” and the RIGHT CURSOR BUTTON function is on. Click on the letter G to go backwards, and on the letter H to go forward. The NAV type pages have a „wrap-around” feature; the other pages scroll up and down only.

8. **ENTER BUTTON:** Used to set entered data in the current data entry highlighted field into the active state.
9. **RT PAGE TYPE ID:** Displays the current right group page type and sub-page number.
10. **CLEAR BUTTON:** Used to clear, or exit, the current data entry highlighted field. Also used to de-clutter the moving map in the NAV 5 and Super NAV 5 pages.
11. **DIRECT-TO BUTTON:** Use this button to initiate entry of the ICAO identification code of the desired airport on the direct-to page. The RIGHT INNER KNOB must be in and rotated once to the right to allow code entry by the keyboard. The entered destination is activated, and the direct-to page exited, by clicking on the ENTER BUTTON. If you are currently GPS tracking, the aircraft will immediately begin to track directly to the new destination.
12. **NAV MODE TYPE:** Indicates if the unit is in the ENROUTE-LEG or the OBS mode of navigation.
13. **ALT BUTTON:** Used to enter the altitude alert page. Altitude alerting is used when in the vertical navigation mode (NAV 4 page) to provide an ALERT warning that a specified altitude is reached. The altitude alerting function is turned on and off, and the altitude to initiate the alarm is entered, on this page. Data is entered using the left group knob and cursor button. Also used to exit the altitude alert page.
14. **LT PAGE TYPE ID:** Displays the current left group page type and sub-page number.
15. **MSG BUTTON:** Used to view messages on the message page. The letters MSG will be displayed on the right of the lower, middle rectangle when a message is available. Hold the button down for 2 seconds to delete the prompt.
16. **LEFT INNER KNOB:** Primary function is to scroll forward and backward through the left group page type sub-pages. The LEFT CURSOR BUTTON function must be off. Used to enter data when the LEFT CURSOR BUTTON function is on. Click on the letter A to go backwards, and on the letter B to go



forward. The NAV type pages have a „wrap-around” feature; the other pages scroll up and down only. This knob is also used to zoom the map out (letter I) and in (letter J).

17. **LEFT OUTER KNOB:** Primary function is to scroll forward and backward through the left group page types. The LEFT CURSOR BUTTON function must be off. Used to scroll through highlighted fields when the LEFT CURSOR BUTTON function is on. Click on the letter C to go backwards, and on the letter D to go forward.
18. **LEFT PAGE TYPES:** Lists the 8 page types available in the left group. Scroll forward or backwards through the list using the LEFT OUTER KNOB.
19. **LEFT CURSOR BUTTON:** Initializes data entry mode to allow data entry into the left group pages. A background rectangle highlights the value to be changed. Also used to exit the data entry mode. The letters CRSR are displayed in place of the page type name and number when the cursor function is on.

System use

The basic setup of the KLN 90B is straight forward. There are 5 buttons along the bottom of the unit which serve specific pages or functions (discussed later). The remaining pages are divided into 2 separate groups whose associated functions are located on the left (8 page types) or right (10 page types) side of the unit. Each side contains 2 concentric buttons to enter data, a cursor button to initiate data entry, and a display screen to display the page information. Normally, both left and right group screens are displayed at the same time, however there are exceptions such as in the case of the Super Nav1 and Super Nav2 pages.

The page annunciations, names, and numbers are listed below:

Page	Knob	Page Name	Page Numbers
Left Group			
NAV	NAV	Navigation	1-5
CAL	CALC	Calculator	1-7
STA	STAT	Status	1-5
SET	SETUP	Setup	0-2
OTH	OTHER	Other	5-10
TRI	TRIP	Trip Planning	0-2
MOD	MODE	Mode	1-2
FPL	FPL	Flight Plan	0-0
Right Group			
NAV	NAV	Navigation	1-5
APT	APT	Airport Wpt	1-8
VOR	VOR	VOR Wpt	0-0
NDB	NDB	NDB Wpt	0-0
INT	INT	Intersection Wpt	0-0
SUP	SUP	Supplemental Wpt	0-0
CTR	CTR	Center Wpt	1-2



REF	REF	Reference Wpt	0-0
ACT	ACT	Active Wpt.	0-0
D/T	D/T	Distance/Time 1-4	

Information retrieval and data entry are also straight forward in the KLN 90B. Information is retrieved by going to the page containing the desired information using the outer and inner knobs. The current page type name and sub-page number is displayed below the screen. To change pages, the cursor button function must be off, and in the case of the right group, the RIGHT INNER KNOB must be out.

Data entry into the left group pages is initiated by going to the appropriate page and then clicking on the LEFT CURSOR BUTTON. When the cursor button is clicked, a rectangle will appear behind the first data entry field and the value can be changed using the LEFT INNER KNOB. Data entry fields, and the accompanying background rectangle, are changed using the LEFT OUTER KNOB. When changed to a new field, the inner knob is used once more to change the value. Click again on the cursor button to exit the cursor function.

Below is an example of entering 3 numbers into a page:

- Turn on the unit by clicking on the POWER/BRT/DIM KNOB BUTTON, and then clicking the ENTER BUTTON once to accept the information and to enter the pages.
- Say we want to replace the value 205 with the value 123 as the calculated airspeed (CAS).
- Use the LEFT INNER and OUTER KNOBs to go to the CAL 2 page.
- Now click on the LEFT CURSOR BUTTON and a rectangle appears behind the number 2.
- Click on the bottom left of the left inner knob to decrease the 2 to a 1.
- Now click on the upper right of the left outer knob to shift the data entry field, and rectangle, to the second digit, 0.
- Click on the bottom right inner knob 2 times to increase the value to 2.

- Click on the outer knob to get to the next field, and then click 2 times on the left inner knob to decrease the value from 5 to 3. If a mistake is made, you can scroll back to the mistaken value with the left outer knob and then change it using the left inner knob.
- The value 123 is now displayed, and clicking on the cursor button will enter the value and exit the cursor function. In general, the cursor function can be exited at any time by clicking on the cursor button. Also keep in mind that the numbers can be entered using your keyboard.

Data is entered into the right group pages in the same manner as described for the left group. The major difference is that the RIGHT INNER KNOB has an „in“ and „out“ position, and each is involved in different functions. Below is an example of changing the VOR from ABC to XYZ:

- Use the RIGHT OUTER KNOB to go to the VOR page.
- Click the RIGHT INNER KNOB to the in position, and then click on the RIGHT CURSOR BUTTON.
- The data entry field to be changed is highlighted by a background rectangle.
- Click the RIGHT INNER KNOB and a rectangle appears over the first data entry field.
- Use the right inner knob to change the letter A to the letter X.
- Next click on the right outer knob to shift the data entry field, and rectangle, over to the next letter.
- Use the right inner knob to change the letter B to the letter Y.
- Use the outer and inner knobs to change the last field as above.
- Click on the right cursor button to enter the value and exit the cursor function. Note you can also use your keyboard to enter the letters.



The following pages describe each different page in some detail. The approach taken is to discuss the pages of the left group starting with the NAV type page and going „forward“ through the pages until the left NAV type is displayed again. The right group will be discussed next, again going forward through the pages from the NAV page until all pages are discussed. The pages served by the 5 buttons will be discussed last. The format will be to display an example figure, a brief description of the functions performed on each page, a definition of the information on each line, and last a description on how to use each page when required.

NAV: Navigation pages

The navigation pages contain information specifically related to the navigational status of the flight. There are 5 navigation pages. The first 3 pages are information only pages that require no user input. The navigation pages are unique among the different page types in they are the only page types present in both left and right page type groups. This feature allows each page to be displayed at the same time on the left and right screens. It also provides a way to display the „super“ NAV 1 and NAV 5 pages (discussed below).

NAV 1: Navigation 1 Page (NAV 1)



Fig 1.1



Fig 1.2

Examples of a typical NAV 1 page are shown above. The NAV 1 page has 6 lines of information as listed below:

- **Line 1:** Displays the active navigation leg. Fig 1.1 shows the display when tracking waypoints of a flight plan. The identifier at the left is the previous wpt, and to the right the next wpt. The arrow shows you are tracking to the next wpt. Fig 1.2 shows the display when tracking directly to a destination in the Direct-To mode. There is no previous wpt, and a letter D is displayed over the arrow.
- **Line 2:** Displays a course deviation indicator. The vertical bar slides to the left and right to indicate distance from the desired track. The aircraft is on track when the needle is directly over



the triangle. Each plus sign on the scale represents 1 nm off-track, therefore the CDI covers 5 nm to the left and 5 nm to the right of the desired track. The triangle in the center of the scale points up when tracking to a wpt, and points down when tracking from a wpt.

- **Note:** The CDI scale factor can be changed from 5 nm to 1 nm, or to 0.2 nm in either the MOD 1 or MOD 2 page.
- **Line 3:** Displays the distance to the next active wpt in nautical miles (nm). In the Direct-To mode the destination is the next active wpt.
- **Line 4:** Displays the ground speed in knots (kt).
- **Line 5:** Displays the estimated time enroute (ETE) to the next active wpt. The format is HH:MM.
- **Line 6:** Displays the bearing to the next active wpt in degrees magnetic north.

SUPER NAV 1: Super navigation 1 page



Fig 1.4

The Super NAV 1 page is displayed when both the left and right page type groups are set to the NAV 1 page. A typical example is shown in Fig 1.3. It displays the exact same information displayed on the NAV 1 page, but presented in a larger and easier to read format.

NAV 2: Navigation 2 Page (NAV 2)



Fig 1.4

The navigation 2 page displays the present position of the aircraft in 2 ways. The first way is by listing the direction and distance to the nearest VOR. The second way is by listing the latitude and longitude of the aircraft. This page is set as the left screen display at startup to allow the user to determine the aircraft position at that time. The navigation 2 page has 5 lines of information and an example of this page is shown in Fig 1.4. Listed below is a description of the different lines of information.

- **Line 1:** Display to indicate the information refers to the present position of the aircraft.
- **Line 2:** Display listing the nearest VOR to the current aircraft position. The VOR identifier code is shown to the left. The next display to the right is the magnetic north degrees to or from the VOR, with an annunciation to show the direction is from the VOR.
- **Line 3:** Display listing the distance to the VOR in nm.
- **Line 4:** Display showing the present latitude of the aircraft.
- **Line 5:** Display showing the present longitude of the aircraft.



NAV 3: Navigation 3 Page (NAV 3)



Fig 1.5

The navigation 3 page is shown in Fig 1.5. This page has 6 lines of information which are discussed below.

- **Line 1:** The display on this line is exactly the same as the NAV 1 page line 1 display. The annunciation shown in the above figure shows the display when in the Direct-To mode.
- **Line 2:** Displays the desired track to the active wpt in degrees magnetic north.
- **Line 3:** Displays the aircrafts current track over the ground in degrees magnetic north.
- **Line 4:** Displays the cross track error correction in nm. The number lists the distance from the desired track, and the arrow indicates which way the aircraft needs to fly to get back on track.
- **Line 5:** Displays the minimum safe altitude. For this aircraft (not the real one) the MSA is defined as the indicated altitude of the aircraft plus 1000 feet when the aircraft is below 5000 ft AGL, and plus 2000 feet when above this altitude.
- **Line 6:** Displays the minimum enroute safe altitude. Not functional in this unit.

NAV 4: Navigation 2 Page (NAV 4)



Fig 1.6



Fig 1.7



Fig 1.8



Fig 1.9

The navigation 4 page is used to enter the parameters used by the unit to compute ascending or descending paths in the vertical navigation mode (VNV). This page interfaces with the autopilot, and usually the autopilot altitude hold function is used during vertical navigation. There are 5 lines of information on this page; the last 3 lines are changed by the user during vertical navigation. There are two ways to use the vertical navigation feature. One way is to begin an ascent or descent from the current location and another is to begin at a later time and place. Both ways are discussed below. The NAV 4 page can be displayed on either the left or right display screens, or both simultaneously.

The basic idea in this type of vertical navigation is to define a point in space before and above the next active wpt, defined in terms of distance from the wpt and feet above the ground, and then choose the vertical speed and airspeed you would like to use to get to that point. The



KLN 90B uses this information to determine an „advisory” altitude to „advise” you of the altitude you need to be at, at any given time during VNAV, to arrive at the chosen point in space. Both the indicated and advisory altitudes will increase and decrease as you ascend or descend, respectively, and the idea is to keep the indicated altitude value matched with the advisory altitude value during the descent. Note the advisory altitude changes according to the entered vertical speed and airspeed values, which are usually not the true, exact values. The values should remain close, however if they do not the vertical speed can be adjusted to get them to match. If they are matched when the aircraft levels off at the designated altitude, you will be at the height and distance from the active wpt you set earlier.

Examples of the vertical navigation page are shown in Figs 1.6-1.9 above. The information presented in line 1 of Figs 1.7 and 1.8 is not displayed when in the time mode. The meaning of each line of this page is discussed below.

- **Line 1:** The information displayed on the right of this line changes according to the state of vertical navigation. The VNV annunciation on the left indicates you are on the vertical navigation page, and is always displayed when on this page. Fig1.6 shows the display when vertical navigation is off. INACT is annunciated to indicate vertical navigation is inactive. Fig1.7 shows the display when vertical navigation is on and you are more than 10 minutes from the determined ascent or decent point. If you are between 0 and 10 minutes from the point, line 1 will appear as shown in Fig1.8. Fig1.9 shows this line as it is displayed when you are ascending or descending, with the advisory altitude on the far right.
- **Line 2:** Display of the indicated altitude in feet above MSL. Match this value to the advisory altitude during ascent or descent by changing the vertical speed value on the KAS 297C pre-altitude selector.
- **Line 3:** Displays the height above MSL of the point in space you are defining. Enter the desired value by going to the NAV 4 page, clicking on the cursor button, using the outer knob

to change data entry fields, and changing the values with the inner knob. The altitude value increments/decrements in units of 100.

- **Line 4:** Displays the distance from the next active wpt to the point in space you are defining. Enter the desired value by going to the NAV 4 page, clicking on the cursor button, using the **outer knob** to change data entry fields, and changing the values with the **inner knob**. The distance value increments/decrements in units of 10 and 1 to a maximum of 99. The next active wpt identity is displayed on the left side of the line. The „-“ sign displayed to the immediate left of the entered number indicates you are in the descend mode of vertical navigation. It is replaced by a „+“ sign when in the ascending mode.
- **Line 5:** Displays the angle of the aircraft flight path used to ascend or descend to the chosen point in space. When in the immediate descent mode this value is not changed by the user, and the current angle will be displayed through out the descent. The value increases as you get nearer to the next active wpt. If in the vertical navigation delay mode the angle value is set by the user and is the angle the unit uses to determine the advisory altitude. The „-“ sign displayed to the immediate left of the entered number indicates you are in the descend mode of vertical navigation. It is replaced by a „+“ sign when in the ascending mode. To determine the vertical speed in feet per minute for a given angle, go to the CAL 4 page and use the program to calculate the fpm from the angle and the airspeed. When entering the airspeed on that page however, remember the desired airspeed is the speed to be used during the descent, not necessarily the current airspeed.

There are several ways to use the vertical navigation feature. One way is to begin to ascend or descend from the current location at the vertical speed dictated by the displayed angle. The angle displayed at this time is the angle the unit has determined will take you from your current location, at your current airspeed, to the defined point in space.



To use this calculator page,

1. Use the angle value on Line 6, along with the desired airspeed, on the CAL 4 page to determine the corresponding vertical speed in feet per minute.
2. Enter the desired altitude and distance from the next active wpt on Lines 3 and 4, respectively, of the NAV 4 page.
3. Click on the outer knob when the cursor is over the last data field of Line 4 (x1 digit), to move the cursor to the next data field on Line 5, and activate the vertical speed mode. A green transparent rectangle will appear behind the ANGLE annunciation. When the vertical navigation mode is activated, the new altitude and the determined vertical speed must set into the KAS 297C if using the autopilot.
4. Keep the indicated altitude matched to the advisory altitude during the ascent or descent to arrive at your chosen point in space. Use of the vertical speed hold function of the KAS 297C is advised.
5. Alternatively, if you know the angle of ascent or descent you want to use, you can enter the altitude and distance from the next active wpt on the NAV 4 page and watch as the angle increases as you get nearer to the wpt. When the angle displayed is equal to the angle you have chosen, vertical navigation is started as described above. Again, keep the indicated altitude matched to the advisory altitude during the ascent or descent descent to arrive at your chosen point in space.
6. You can also set the desired values for vertical navigation ahead of time and allow the KLN 90B to compute, and notify you, when it is time to start the ascent or descent. Unlike above, the user also enters the angle of ascent or descent they desire on Line 5. With this additional information the unit determines the time when the ascent or descent must be started to travel at that angle to get to the desired point in space. This feature of vertical navigation is activated when the cursor is moved to the angle data field on Line 5, past the ANGLE annunciation.

7. When activated, and the aircraft is further than 10 minutes from the ascent or descent point, the word ARMED will be displayed on the right of Line 1 as shown in Fig 1.7. When the aircraft is between 0 and 10 minutes from the ascend or descend point, a count-down timer will be displayed as shown in Fig 1.8. The words „VNV ALERT“ will be displayed across the screen in red between 90 and 60 seconds from the ascend or descend point to alert the user of the impending start. This is a good time to prepare for the descent or ascent, specifically the airspeed and vertical speed.
8. At 0 time the advisory altitude is displayed on the right side of Line 1 as shown in Fig 1.9 and the value start to go up (ascending) or down (descending). The user then sets the KAS 297C altitude and vertical speed to get to the desired point in space as discussed above. Use the KAS 297C vertical speed feature to keep the indicated altitude matched to the advisory altitude.

An example using the latter vertical navigation type on a Direct-To GPS flight from Tuscon International (KTUS) to Phoenix Sky Harbor (KPHX) is illustrated below:

Figs 1.6-1.9 show the displays of the NAV 4 page at different times of the trip. I first set the KLN 90B for a direct flight using the Direct-To feature. After take-off and climbing, I leveled off at 12,000 ft above MSL at 225 kts GS with the NAV 4 page displayed as shown in Fig 1.6. At approximately 75 miles outside of KPHX, I set the selected altitude to 2100 feet (MSL), and the distance to 10 nm to get to the KPHX pattern altitude of 2100 ft above MSL at 10 miles out. I decided to descend to that point at a rate of 1600 fpm at 200 kts GS. I determined on the CAL 4 page that this vertical speed and GS corresponded to an angle of ~4.1 degrees. I then entered this value on Line 5 of the NAV 4 page. The INACT annunciation on Line 1 was replaced by the ARMED annunciation showing the unit was activated. At 10 minutes from the descend point the unit began to count down from 10 minutes. Fig 1.8 shows a display of the NAV 4 page taken at 6 minutes and 10 seconds from the descend point. When there was ~5 minutes to go to the descend point, I used the autopilot airspeed function to slow the aircraft to ~200 kts groundspeed. At 0 time, the advisory altitude



replaced the ARMED annunciation. I set the KAS 297C altitude value to 2100 ft, and the vertical speed to 1600 fpm. Fig. 1.9 shows the display at about 4400 ft above MSL. At this time I was doing well on the descent as shown by the closeness of the indicated and advisory altitudes, and by the remaining distance. The autopilot leveled the aircraft at 2100 ft and the distance to KPHX was 10 nm.

NAV 5: Navigation 5 Page (NAV 5)

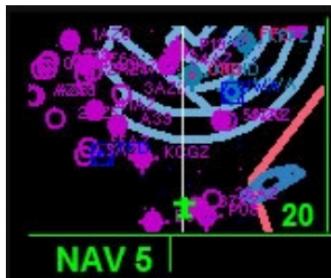


Fig 1.10

The navigation 5 page displays a moving map. The range value of the map can be changed by zooming in or out using the LEFT INNER KNOB (letters I and J), and the map display can be „de-cluttered” using the CLR button. Note using the zoom function on the left screen will cause the Nav1 page to be displayed on the right screen. The range values go from 200 ft to 500 nm and the current value is annunciated at the lower right of the screen. ILS arrows for ILS capable runways are displayed on the map to aid in ILS approaches. The symbolic aircraft shows your position on the map.

SUPER NAV 5: Super Navigation 5

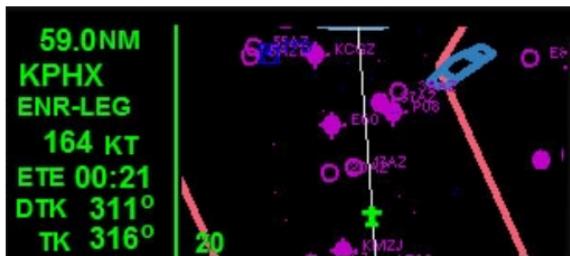


Fig 1.11

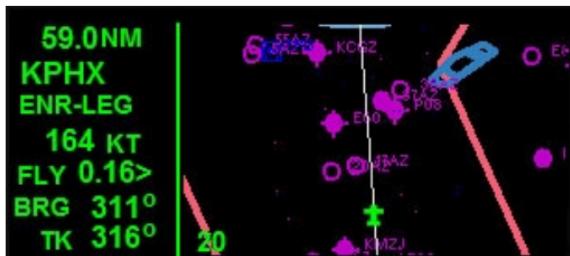


Fig 1.12

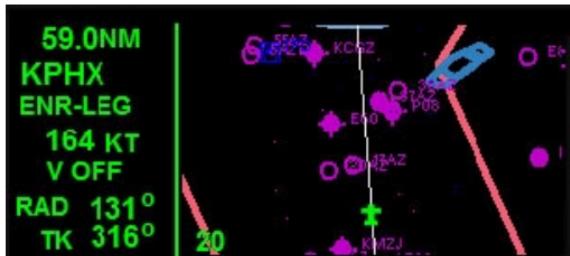


Fig 1.13

The super navigation 5 page is displayed when the NAV 5 page is chosen from both left and right page groups at the same time. This page provides the user with basic relevant navigation data displayed in the context of a moving map. The information displayed on the map is exactly the same information displayed on the NAV 5 page, and the range and clutter can be changed as discussed. On this page however, the map is larger and the range factor is displayed at the lower left of



the map. All of the data contained on the map is informative only and the values cannot be changed by the user directly (excepting the range factor).

Figs 1.11-1.13 show examples of the super navigation 5 page. There are 7 lines of navigational information. The information displayed on the first 4 lines cannot be changed, however the information fields displayed on the last 3 lines can be changed to display different information field (see the figures above). The information displayed on the 7 lines is discussed below.

- **Line 1:** Displays the distance to the next active wpt, in nm.
- **Line 2:** Displays the ICAO code of the next active wpt.
- **Line 3:** Indicates if navigation is in the ENROUTE LEG or OBS mode.
- **Line 4:** Displays the current GS in kts.
- **Line 5:** Displays 1 of 3 information fields: 1) estimated time enroute (ETE) in a min:sec format, 2) cross track error in nm accompanied by a relative position arrow, or 3) vertical navigation information as displayed on the upper right hand screen of the NAV 4 page. This allows you to observe the progress of vertical navigation while viewing the super navigation 5 page.
- **Line 6:** Displays 1 of 3 information fields: 1) the desired track to the next active wpt in degrees magnetic north, 2) the bearing to the next active wpt in degrees magnetic north, or 3) the radial from the next active wpt in degrees magnetic north.
- **Line 7:** Displays 1 of 3 information fields: 1) the current aircraft track over the ground in degrees magnetic north, 2) the bearing to the next active wpt in degrees magnetic north, or 3) the radial from the next active wpt in degrees magnetic north.

As stated above, the last 3 lines of the super navigation 5 page can be changed to display 3 different information fields each.

1. To change the information fields, first click on the LEFT CURSOR BUTTON while in the super navigation 5 page. This will set the active cursor on Line 5. A rectangle will appear over the line with the annunciations „ETE“, „FLY“ or „VNAV“ depending on the current information field.
2. Use the LEFT INNER KNOB to scroll forward and backward through the 3 choices. The annunciations displayed on the rectangle only tells you what information field is current; the information in the field is not observed until you set the value by moving to another line or by exiting using the LEFT CURSOR BUTTON.
3. Next click on the LEFT OUTER KNOB to move to Line 6. The information on Line 5 is now observable and the cursor rectangle is positioned on Line 6 showing one of the following annunciations: „DTK“, „BRG“, or „RAD“. Again, use the LEFT INNER KNOB to choose the information field desired.
4. Click on the LEFT CURSOR BUTTON to exit data entry or click on the LEFT OUTER KNOB to move the cursor rectangle to Line 7.
5. Repeat the above process to choose the desired information field on Line 7.
6. Next click on the LEFT CURSOR BUTTON to exit the data entry mode, or use the LEFT OUTER KNOB to scroll back to Lines 5 or 6.
7. The LEFT INNER KNOB is used to change the range factor of the map when the cursor function is on. If the cursor is positioned on Line 5, you can click on the left side of the LEFT OUTER KNOB to go directly to the range field. A rectangle will appear behind the range factor annunciation located on the bottom left side of the map. Use the LEFT INNER KNOB to increase or decrease the range factor. Alternatively, scrolling past Line 7 by clicking on the right side of the LEFT OUTER KNOB will also get you to the range field.



CALC: Calculator pages

The calculator pages allow the user to determine the affect changing a navigation parameter has on other interrelated navigation parameters. The manufacturer calls these pages the „what if” pages. For example, what if you wanted to know the new heading to use to stay on course if the wind direction changed? If you were enroute and knew the wind direction was different up ahead of you, you could go to the calculator pages and determine the new heading before you get to the change. Changes in the air are not the only flight related variables that can be calculated on these pages. A partial list includes variables such as pressure and density altitude, TAS, winds aloft, temperature, and VNAV angle. There are also several conversion functions, including a time conversion table that can be used to compare local times between all of the different time zones in the world.

The calculator pages are setup by default to show the current flight related information. This information will be displayed only as long as the values are not changed. This allows you to see the current values immediately before changing them. There are 7 different calculator pages, and each is discussed below. The „::” is displayed on lines of information that can be changed by the user.

CALC 1: Calculator 1 Page (CAL 1)



Fig 2.1

The calculator 1 page is used to determine pressure and density altitudes at any given combination of indicated altitude, barometric pressure, and temperature. The latter 3 values are entered by the user. There are 6 Lines of information.

- **Line 1:** Indicates this page displays and calculates altitude data.
- **Line 2:** Displays the user entered altitude in feet above MSL.
- **Line 3:** Displays the user entered barometric pressure in inches of Hg. Can also be set to display millibars of pressure using the SET 6 page.
- **Line 4:** Displays the calculated Pressure Altitude in feet above MSL based on the altitude and barometric pressure entered by the user.
- **Line 5:** Displays the user entered ambient temperature in degrees Celsius.
- **Line 6:** Displays the Density Altitude in feet above MSL based on the ambient temperature and the Pressure Altitude.



To use this calculator page:

1. Display the CAL 1 page on the left screen and click on the LEFT CURSOR BUTTON.
2. Use the LEFT OUTER KNOB to scroll through data entry fields, and the LEFT INNER KNOB to change the values. Each data entry field is highlighted with a background rectangle to show the current field to be changed. The Pressure and Density Altitudes will be computed as you enter the data.
3. Exit the data entry mode at any time by clicking on the LEFT CURSOR BUTTON. All data entered in the session will be retained.

CALC 2: Calculator 2 Page (CAL 2)



Fig 2.2

The calculator 2 page is used to calculate the aircraft's true airspeed (TAS) based on user entered values of calibrated airspeed, indicated altitude, barometric pressure, and the total air temperature. There are 6 Lines of information, 4 of which are used for data entry.

- **Line 1:** Display to indicate this page is used to calculate TAS.
- **Line 2:** Display of the user entered calibrated airspeed (indicated airspeed) in knots.
- **Line 3:** Display of the user entered altitude in feet above MSL.

- **Line 4:** Display of the user entered barometric pressure in inches of Hg. Can also be set to display millibars of pressure using the SET 6 page.
- **Line 5:** Displays the user entered total air temperature in degrees Celsius.
- **Line 6:** Displays the TAS of the aircraft in knots as calculated from the user entered values.

To use this calculator page:

1. Display the CAL 2 page on the left screen and click on the LEFT CURSOR BUTTON.
2. Use the LEFT OUTER KNOB to scroll through data entry fields, and the LEFT INNER KNOB to change the values. Each data entry field is highlighted with a background rectangle to show the current field to be changed. The TAS will be computed as you enter the data.
3. Exit the data entry mode at any time by clicking on the LEFT CURSOR BUTTON. All data entered in the session will be retained.

CALC 3: Calculator 3 page (CAL 3)



Fig 2.3

The calculator 3 page is referred to as the „wind“ page. Use this page to determine the headwind or tailwind based on the TAS and aircraft heading. This page also displays the direction (true north) and strength of the wind. There are 6 lines of information.



- **Line 1:** Indicates this page is used for calculations relating to wind parameters.
- **Line 2:** Displays the user entered TAS in knots.
- **Line 3:** Displays the user entered aircraft heading in degrees magnetic north.
- **Line 4:** Displays if the wind has a headwind or tailwind component relative to the aircraft heading. Also displays the strength of the wind component in knots. HDWIND refers to a headwind, and TLWIND refers to a tailwind.
- **Line 5:** Displays the wind direction in degrees true north.
- **Line 6:** Displays the wind strength in knots.

To use this calculator page:

1. Display the CAL 3 page on the left screen and click on the LEFT CURSOR BUTTON.
2. Use the LEFT OUTER KNOB to scroll through data entry fields, and the LEFT
3. INNER KNOB to change the values. Each data entry field is highlighted with a background rectangle to show the current field to be changed. The wind component type and strength will be computed as you enter the data.
4. Exit the data entry mode at any time by clicking on the LEFT CURSOR BUTTON.
5. All data entered in the session will be retained.

CALC 4: Calculator 4 page (CAL 4)



Fig 2.4

The calculator 4 page is used to convert the flight path angle into feet per minute, and vice versa. Input the groundspeed to use during ascent or descent along with the angle displayed on Line 5 of the NAV 4 page, and the unit will calculate what this value corresponds to in fpm. Enter the fpm value into the KAS 297C vertical speed page. Alternatively, enter the GS and the fpm you want, and the unit will compute the corresponding angle to enter on Line 5 of the NAV 4 page. If you are tracking to a wpt, the default page will display the angle required to go from the current location to the point in space previously defined, based on the current airspeed. There are 4 Lines of information displayed on this screen.

- **Line 1:** Display to show you are on the page used to calculate ascent or descent flight paths for vertical navigation.
- **Line 2:** Display of the user entered GS in knots.
- **Line 3:** Display of the user entered, or calculated, vertical speed in fpm.
- **Line 4:** Display of the user entered, or calculated, ascend/descend flight path angle in degrees relative to the ground.



To use this calculator page:

1. Display the CAL 4 page on the left screen and click on the LEFT CURSOR BUTTON.
2. Use the LEFT OUTER KNOB to scroll through data entry fields, and the LEFT
3. INNER KNOB to change the values. Each data entry field is highlighted with a
4. background rectangle to show the current field to be changed. All values will be computed as you enter the data.
5. Exit the data entry mode at any time by clicking on the LEFT CURSOR BUTTON. All data entered in the session will be retained.

CALC 5: Calculator 5 Page (CAL 5)



Fig 2.5

The calculator 5 page is used to convert degrees Celsius to Fahrenheit, and vice versa, to convert between nautical and statute miles per hour. There are 5 lines of information.

- **Line 1:** Display to indicate the page is used for temperature and speed conversions.
- **Line 2:** Display of the user entered or corresponding Fahrenheit temperature in degrees Celsius.
- **Line 3:** Display of the user entered or corresponding Celsius temperature in degrees fahrenheit.

- **Line 4:** Display of the user entered or corresponding mph speed in nautical miles per hour.
- **Line 5:** Display of the user entered or corresponding nm per hour speed in statute miles per hour.

To use this calculator page:

1. Display the CAL 5 page on the left screen and click on the LEFT CURSOR BUTTON.
2. Use the LEFT OUTER KNOB to scroll through data entry fields, and the LEFT
3. INNER KNOB to change the values. Each data entry field is highlighted with a background rectangle to show the current field to be changed. All values will be computed as you enter the data.
4. Exit the data entry mode at any time by clicking on the LEFT CURSOR BUTTON. All data entered in the session will be retained.

CALC 6: Calculator 6 Page (CAL 6)



Fig 2.6

The calculator 6 page is used to convert the time in one time zone to the corresponding time in another zone. Lines 2 and 3 in Fig2.6 display the time, 3 letter time zone code, and time zone name for 1 set, and Lines 4 and 5 shows the corresponding information in another set. The user can change the time and time zone of either set, and when the time is changed in one set it is changed accordingly in the other set. A



default screen example is shown in Fig2.6. The top set of information is set to the local time, and is referenced to universal time displayed in the bottom set. A list of available time zones and their 3 letter codes is shown below. There are 5 Lines of information.

- **Line 1:** Indicates the page is used to for time conversion calculations.
- **Line 2:** Display of user entered information. The left most information is the time in an hrs:min format, while the right side of the line displays the time zone code.
- **Line 3:** Displays the time zone name corresponding to the 3 letter time zone code entered on Line 2.
- **Line 4:** Display of user entered information. The left most information is the time in an hrs:min format, while the right side of the line displays the time zone code.
- **Line 5:** Displays the time zone name corresponding to the 3 letter time zone code entered on Line 4.

Time Zones	UTC Reference Time	Time Zone
Coordinated Universal Time	ZULU	UTC
Greenland Standard Time	UTC-3	GST
Greenland Day Time	UTC-2	GDT
Atlantic Standard Time	UTC-4	AST
Atlantic Day Time	UTC-3	ADT
Eastern Standard Time	UTC-5	EST
Eastern Day Time	UTC-4	EDT
Central Standard Time	UTC-6	CST
Central Day Time	UTC-5	CDT
Mountain Standard Time	UTC-7	MST
Mountain Day Time	UTC-6	MDT
Pacific Standard Time	UTC-8	PST
Pacific Day Time	UTC-7	PDT

Alaska Standard Time	UTC-9	AST
Alaska Day Time	UTC-8	ADT
Hawaii Standard Time	UTC-10	HST
Hawaii Day Time	UTC-9	HDT
Samoa Standard Time	UTC-11	SST
Samoa Day Time	UTC-10	SDT

To use this calculator page:

1. Display the CAL 6 page on the left screen and click on the LEFT CURSOR BUTTON.
2. Use the LEFT OUTER KNOB to scroll through data entry fields, and the LEFT INNER KNOB to change the values. Each data entry field is highlighted with a background rectangle to show the current field to be changed. All values will be computed as you enter the data.
3. Exit the data entry mode at any time by clicking on the LEFT CURSOR BUTTON. All data entered in the session will be retained.

To use the time conversion calculator:

1. Refer to Fig 2.6 as the starting point. This figure shows the relationship between Pacific Day Time and UTC. We want to change the PDT to EDT.
2. Go to the CAL 6 page and click on the LEFT CURSOR BUTTON. A rectangle will appear behind the hour display in the upper set and the value can be changed using the LEFT INNER KNOB if desired.
3. Click on the LEFT OUTER KNOB to position the cursor over the 10 minute value. Change if desired.
4. Click again on the LEFT OUTER KNOB to position the cursor over the 1 minute value and change with the LEFT INNER KNOB if desired.
5. Click the LEFT OUTER KNOB again to position the cursor rectangle over the PDT annunciation. Use the LEFT INNER KNOB to scroll through the list of time zones and choose EDT.



The UTC time listed on Line 4 will now change to 20:09 if the time has not been changed from what is listed in **Fig. 2.6**.

6. To see what time 16:09 in the EDT zone is in Alaska Day Time without changing the upper set display, use the LEFT OUTER KNOB to position the rectangle over the time zone code in the bottom set. Use the LEFT INNER KNOB to scroll through the time zones until ADT is displayed. The time displayed on Line 5 will now be 12:09, 4 hours behind EDT, and 8 hours behind UTC. The same information would have been obtained if the ADT had been chosen into the upper set, and the EDT entered into the lower set.
7. Click on the LEFT CURSOR BUTTON at any time to exit data entry.

CALC 7: Calculator 7 page (CAL 7)



Fig 2.7

This page displays the sunrise and sunset for all wpts in the data base. It is currently **IN-OPERABLE**, and is only included to show the KLN 90B's full potential.

STAT: Status pages

The status pages contain information relating to the status of the satellite reception of the KLN 90B. There is no such information in the flight simulator, and accordingly these pages are displayed in this aircraft for learning purposes only. There are 4 status pages. Status pages 1 and 2 display information about the GPS receiver and the GPS satellite being tracked. Status pages 3 and 4 display supplemental information pertaining to the KLN 909B.

SETUP: Stup pages

The setup pages are used to set a number of variables used by other pages. For example, the SET 7 page is used to set barometric pressure values in the CAL 1 and 2 pages as inches of Hg or millibars of pressure. The SET 4 page allows the user to set the flight timer on the D/T 4 page to begin when the unit is powered on, or when the airspeed is greater than 30 knots. Nearest airport runway criteria and altitude alerting pages are also grouped in these pages.

SETUP 1: Setup 1 Page (SET 1)



Fig 3.1

The setup 1 page is used primarily to show the information used by the GPS to obtain an initial position fix. It is basically a nearest airport



page and can be viewed at any time to get a quick „fix“ on the nearest airport without going to the nearest airport pages. This page also displays the longitude and latitude of the nearest airport which is information not supplied on the nearest airport pages. There are 5 Lines of information.

- **Line 1:** Display to identify this page as the initial position „fix“ page.
- **Line 2:** Display listing the identity of the nearest airport by its ICAO identification code.
- **Line 3:** Display of the nearest airport latitude.
- **Line 4:** Display of the nearest airport longitude.
- **Line 5:** Displays the 1) current ground speed in knots, and 2) direction to the nearest airport listed on Line 2 in degrees magnetic north.

SETUP 2: Setup 2 Page (SET 2)



Fig 3.2



Fig 3.3

The setup 2 page displays date and time information. The default screen displays this information as Zulu date and time (**Fig 3.2**), but the display can be changed to show the local date and time (**Fig 3.3**) if desired. There are 4 Lines of information.

- **Line 1:** Display showing the current page is used for date and time functions.
- **Line 2:** Display of the current day, month and year, respectively.
- **Line 3:** Display showing the current time in an hr:min:sec format. The time zone code corresponding to this time is displayed on the right side.
- **Line 4:** Display of the time zone corresponding to the date and time shown.

Click the LEFT CURSOR BUTTON when on this page and use the LEFT INNER KNOB to toggle between Zulu and local dates and time.

SETUP 3: Setup 3 Page (SET 3)



Fig 3.4

The setup 3 page is used to set the minimum runway length and surface type conditions that must be met for an airport to be included in the nearest airport list. The runway length specified can be up to a maximum of 5000 ft, and the choices for runway surface type are „hard“ and „soft“. (**note:** the ‘HRD/SFT’ function is currently in-operable). **Fig 3.4** shows a situation where only airports with a minimum runway length of 3500 ft and a hard surface are to be included in the nearest airport list. There are 6 Lines of information.

- **Lines 1 and 2:** The annunciation on these 2 lines indicate the page is used to calculate nearest airport criteria.



- **Line 3:** Display to indicate that the number entered directly below is the minimum runway length.
- **Line 4:** Displays the user entered minimum runway length that must be met to include the airport in the nearest airport list.
- **Line 5:** Display indicating the runway surface type entered directly below is the surface type chosen.
- **Line 6:** Displays the user entered runway surface type an airport must have to be included in the nearest airport list.

To use this setup page:

1. Display the SET 3 page on the left screen and click on the LEFT CURSOR BUTTON.
2. A rectangle will appear behind the entire minimum runway value.
3. Use the LEFT INNER KNOB to change the value to the desired value. The value is incremented and decremented in units of 100 ft up to a maximum value of 5000 ft.
4. Click on the LEFT OUTER KNOB to shift the cursor to the runway surface type location (Line 6). A rectangle will appear behind 1 of 3 annunciations; 1) „HRD SFT”, „HRD”, or 3) „SFT”. The „HRD SFT” annunciation is the unset default display and indicates the 2 set choices available. The other 2 annunciations are displayed if their values had been set previously in the flight.
5. Use the LEFT INNER KNOB to toggle between the unset (#1), hard (#2), and (#3) soft surface type criteria choices. The choice will be highlighted with a background rectangle to show the cursor location, and will remain displayed when data entry is completed and the rectangle is not visible.
6. Each data entry field is highlighted with a background rectangle to show the current field to be changed. All values will be computed as you enter the data.
7. Exit the data entry mode at any time by clicking on the LEFT CURSOR BUTTON. All data entered in the session will be retained.

SETUP 4: Setup 4 Page (SET 4)



Fig 3.5

The setup 4 page is used to set the conditions for the automatic start of the flight timer displayed on Line 2 of the D/T 4 page. The choices include for the flight timer to start when the unit is powered on, as displayed in Fig3.5, or when the aircraft airspeed is greater than 30 knots. There are 6 Lines of information.

- **Lines 1-3:** These 3 lines show you are on the flight timer setup page.
- **Line 4:** Display to indicate that the choice made on the next Line is when the timer will start to run.
- **Line 5:** Displays the condition whereby the flight timer starts automatically.

To use this setup page:

1. Display the SET 4 page on the left screen and click on the LEFT CURSOR BUTTON. A long rectangle will appear behind the word annunciation.
2. Use the LEFT INNER KNOB to toggle between the 2 choices.
3. Exit the data entry mode at any time by clicking on the LEFT CURSOR BUTTON. The background rectangle will disappear. All data entered in the session will be retained.



SETUP 5: Setup 5 Page (SET 5)



Fig 3.6

The setup 5 page functions in the Height Above Airport Alert feature of the KLN 90B. The height above airport alert feature is a feature to alert the user when the aircraft altitude is at a certain height above (user entered value), but less than 2000 ft, and within 5 nm of the next active wpt. One obvious use of this feature is to be notified when you are at pattern altitude during an approach. The height above the airport is set on this page, and the feature is also turned on and off on this page. The height value entered is the actual height above the airport, not the altitude above MSL. The value entered is added to the altitude of the next active wpt. A large red „APT ALERT“ annunciation is displayed on the screen when the entered height is reached, and remains on until the feature is reset or turned off. There are 5 Lines of information.

- **Lines 1 and 2:** Indicates the page displayed is the height above airport alert feature setup page.
- **Line 3:** Displays if the height above airport alert feature is ON or OFF.
- **Line 4:** Indicates the entered value below is the height value used in this feature.
- **Line 5:** Displays the user entered height above the airport to use when the feature is on.

To use this setup page:

1. Display the SET 5 page on the left screen and click on the LEFT CURSOR BUTTON.
2. A rectangle will appear behind the word ON or OFF, depending on the current annunciation.
3. Use the LEFT INNER KNOB to toggle between ON and OFF.
4. Click on the LEFT OUTER KNOB to go to the height entry line (Line 5). The rectangle behind the ON/OFF annunciation will go off, and a rectangle will appear behind the 1000 place digit of the number.
5. Use the LEFT INNER KNOB to change this number as desired. The maximum value of this digit is 2.
6. Use the LEFT OUTER KNOB to move the active field location, and the LEFT INNER KNOB to enter values until the desired height is entered. The last 3 digits of the height value have a maximum value of 9, but will be inactive any time the height value reaches 2000 ft.
7. Exit the data entry mode at any time by clicking on the LEFT CURSOR BUTTON. All data entered in the session will be retained. All data entry fields can be scrolled through forwards and backwards.



SETUP 6: Setup 6 Page (SET 6)



Fig 3.6

The setup 6 page is used to toggle the barometric pressure readout on the initial page, and the CAL 1 and 2 pages, between units of inches of Hg and millibars pressure. There are 4 Lines of information.

- **Lines 1and 2:** Indicates the page viewed is used to set the barometric pressure readout units.
- **Line 3:** Displays a „ „ , annunciation if the setting is for unit readout in inches of Hg; displays MB if the readout is in millibars pressure.
- **Line 4:** Display to show if the barometric pressure readout is set for „INCHES“ or „MILLIBARS“.

To use this setup page:

1. Display the SET 6 page on the left screen and click on the LEFT CURSOR BUTTON. A long rectangle will appear behind the current annunciation at the bottom.
2. Use the LEFT INNER KNOB to toggle between the 2 choices.
3. Click on the LEFT CURSOR BUTTON to exit data entry. The rectangle disappears and the choice displayed at the bottom is used for readout values.

SETUP 7: Setup 7 Page (SET 7)



Fig 3.7

The setup page 7 is used to adjust the volume of the altitude aural alert. It is currently **INOPERATIVE**.

OTHER: Other pages

The other pages are designed to assist the user in fuel management, and to provide pertinent air data information. There are 6 „other“ pages, the first 4 being used for fuel management, and the last 2 used to display air data information. Only the first 2 pages have the ability of user input. User input lines have an „:“ annunciation. The default screens display the current values based on the flightsim input, and will do so until changed by the user. Other pages 1-4 contain information about the internal functioning of the unit, and are not accessible by the user.



OTHER 5: Other 5 Page (OTH 5)

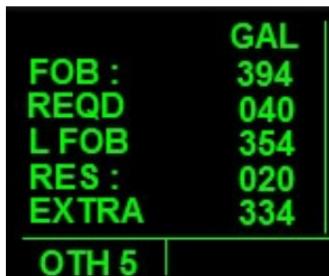


Fig 4.1

The other 5 page displays fuel related information with little input from the user. The user can enter a "fuel on board" amount, and an amount to be held as reserve, and the unit computes the amount of fuel required to reach the destination wpt, the amount of fuel remaining, and an „extra“ amount that takes into consideration the amount of fuel designated as reserve. The amount of fuel reserve is designated by the user. The values displayed on the page are determined from current flight parameters, such as ground speed and power setting, and are therefore subject to change. There are 6 Lines of information on this page.

- **Line 1:** Annunciation indicating the values on this page are expressed in gallons.
- **Line 2:** Displays the number of gallons on board at the current time in the default screen, or displays the value entered by the user.
- **Line 3:** Displays the required number of gallons of fuel required to reach the destination wpt.
- **Line 4:** Displays the calculated total gallons of fuel remaining on board at the destination wpt.
- **Line 5:** Displays the user entered gallons of fuel to „place“ on reserve. The value is 0 unless changed by the user.

- **Line 6:** Displays the „extra“ amount of fuel remaining at the destination wpt taking into account the amount of fuel placed in reserve.

To use this other page:

1. Display the OTH 5 page on the left screen. The information displayed shows the current values. Click on the LEFT CURSOR BUTTON and a rectangle will appear behind the first digit of the FOB line (Line 2).
2. Use the LEFT INNER KNOB to change the current value if desired. Use the LEFT OUTER KNOB to change cursor location, and then use the LEFT INNER KNOB to change the value. Repeat this process until all desired numbers have been entered. Only the values displayed on Lines 2 and 5 can be changed by the user directly.
3. Click on the LEFT CURSOR BUTTON to exit data entry.

OTHER 6: Other 6 Page (OTH 6)

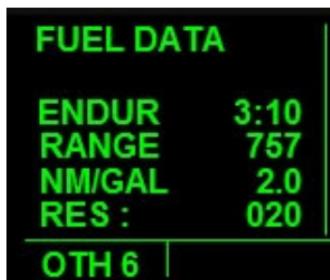


Fig 4.2

The other 6 page displays fuel information including the length of time (endurance) and the distance (range) the aircraft can stay aloft based on the current flight parameters. The user can enter a fuel value to be held in reserve which will be included in the endurance and range calculations. This page also displays the current number of nm traveled per gal of fuel. There are 5 Lines of information.



- **Line 1:** Display indicating the current page contains fuel data.
- **Line 2:** Displays the time the aircraft could go before running out of fuel under the present flight conditions; in an hr:min format.
- **Line 3:** Displays the distance the aircraft could travel under the current flight conditions; in nautical miles.
- **Line 4:** Displays the current distance traveled on a gallon of fuel; in nm per gal.
- **Line 5:** Displays the user entered gallons of fuel to hold in reserve. This value will be subtracted from the total amount of fuel used in endurance and range calculations.

To change the amount of fuel held in reserve, go to the OTH 6 page, click on the LEFT CURSOR BUTTON, and change the value using the LEFT INNER and LEFT OUTER KNOBS as discussed previously.

OTHER 7: Other 7 Page (OTH 7)



Fig 4.3

The other page 7 displays the fuel flow in gals per hour. There are 3 Lines of information. The first line displays the page „functional” title, the second line indicates the data displayed is expressed in gallons of fuel per hour, and the third line displays the actual fuel flow value. There is no user input on this page.

OTHER 8: Other 8 Page (OTH 8)



Fig 4.4

The other page 8 displays the number of gallons of fuel used since the last set point. There are 3 Lines of information. The first line displays the page „functional“ title, the second line indicates the data displayed is expressed in gallons of fuel used, and the third line displays the actual fuel used in gallons. There is no user input on this page.

OTHER 9: Other 9 Page (OTH 9)



Fig 4.5

The other 9 page displays pertinent air data information. The information displayed on this page is similar to that displayed on the CAL 3 page. There is no user input. There are 6 Lines of information.



- **Line 1:** Displays the functional title of the page.
- **Line 2:** Displays the TAS of the aircraft in kts.
- **Line 3:** Displays the mach speed number.
- **Line 4:** Displays the headwind or tailwind component of the wind knots.
- **Line 5:** Displays the wind direction in degrees true north.
- **Line 6:** Displays the current air velocity in knots.

OTHER 10: Other 10 Page (OTH 10)



Fig 4.6

The other 10 page displays additional air data information. This information includes the temperature of the surrounding air, the total air temperature, pressure altitude, and density altitude. There is no user input. There are 5 Lines of information.

- **Line 1:** Indicates the page viewed contains air data information.
- **Line 2:** Display of the saturated air temperature in degrees Celsius.
- **Line 3:** Display of the total air temperature in degrees Celsius.
- **Line 4:** Displays the current pressure altitude in ft.
- **Line 5:** Displays the current density altitude in ft.

TRIP: Trip planning pages

The trip planning pages are used to determine the amount of time, and the fuel required, to go directly from the present position to any other position in the world (within 10,000 nm). There are 3 trip planning pages. The first page is used to enter the TAS and wind data. This data is used by the KLN 90B in calculating an estimated GS to be used in planning specific trips on the TRI 1 and TRI 2 pages. Alternatively, the user can enter and use any GS desired on these 2 pages. The data on the trip planning pages is used by the unit to calculate estimates of distance, ETE, bearing, and fuel requirements. The TRI 1 and TRI 2 pages display the same type of information; the difference being that the TRI 1 page is used to plan a trip from your current position to a wpt, and the TRI 2 page to plan a trip to anywhere.

TRIP 0: Trip Planning 0 Page (TRI 0)



Fig.5.1

The trip planning 0 page is used to enter the TAS, wind direction, and wind strength that will be encountered during the trip that is planned on the TRI 1 or TRI 2 pages. The wind direction, wind strength, and destination direction are used to determine the headwind/tailwind component of the wind which is then used with the TAS to get an estimated GS. The GS is then used with the destination distance to determine the ETE. The GS is also used with the entered fuel flow to determine the fuel required. There are 5 Lines of information.



- **Lines 1 and 2:** Functional title of the TRI 0 page.
- **Line 3:** Displays the user entered TAS in knots.
- **Line 4:** Displays the user entered wind direction in degrees true north.
- **Line 5:** Displays the wind velocity in knots.

To use this Trip page:

1. Display the TRI 0 page on the left screen. Click on the LEFT CURSOR BUTTON and a rectangle will appear behind the first digit of the TAS line (Line 3).
2. Use the LEFT INNER KNOB to change the current value if desired. Use the LEFT OUTER KNOB to change cursor location, and then use the LEFT INNER KNOB to change the value. Repeat this process until all desired numbers have been entered.
3. Click on the LEFT CURSOR BUTTON to exit data entry.

TRIP 1: Trip Planning 1 Page (TRI 1)



Fig 5.2

The trip planning 1 page is used to plan a trip directly from your position to any wpt in the databank. The GS determined by the KLN 90B can be used for calculations on this page, or the user can enter any GS to be used directly. The user enters the destination wpt, and the unit determines the distance and direction to get there. The user can also enter an estimated fuel flow rate and amount to be held in reserve

and the unit will calculate the amount of fuel required to get to the destination. If you choose to enter the GS on this page yourself, you do not have to enter any values on the TRI 0 page. There are 6 Lines of information.

- **Line 1:** Display to show the planned trip goes from your present position to a specific wpt. The wpt is listed on the right side of the line. In the figure above the wpt is KPHX.
- **Line 2:** Displays the distance in nm (left side), and the direction in degrees magnetic north (right side), to the entered destination wpt.
- **Line 3:** Displays the GS in knots (left side), and the time enroute in an hr:min format, to the entered wpt.
- **Line 4:** Displays the user entered fuel flow rate in gallons per hour.
- **Line 5:** Displays the user entered amount of fuel to be used as a reserve in gallons. The amount of fuel in reserve is added to the amount required.
- **Line 6:** Displays the amount of fuel required for the trip in gallons.

To use this trip planning page:

1. Display the TRI 1 page on the left screen. Click the RIGHT INNER KNOB to the „in“ position and then click the RIGHT CURSOR BUTTON.
2. Next click on the LEFT CURSOR BUTTON and a blinking rectangle will appear behind the wpt annunciation.
3. Click on the right side of the RIGHT INNER KNOB to activate data entry. Use the RIGHT INNER KNOB or the keyboard to enter the destination wpt ICAO identifier code.
4. Click on the ENTER BUTTON 3 times to enter the wpt.
5. Now click on the LEFT CURSOR BUTTON to enter the remaining data. A rectangle will be present behind the first digit of the GS data field (left side of Line 3) at this time.
6. Use the LEFT INNER KNOB to change the current value if desired. Use the LEFT OUTER KNOB to change cursor location,



and then use the LEFT INNER KNOB to change the value. Repeat this process until all desired numbers have been entered.

7. Click on the LEFT CURSOR BUTTON to exit data entry. The unit will now display the ETE and fuel required for the trip based on the data entered.

TRIP 2: Trip Planning 2 Page (TRI 2)



Fig 5.3

The trip planning 2 page displays the same type of information as the TRI 1 page, however on this page you can plan a trip from your present position to anywhere in the world. Unlike on the TRI 1 page, you enter the distance and direction to a destination point instead of a wpt. The KLN 90B then calculates the information based on the entered data. If you set the GS or fuel flow on the TRI 1 page, they will be displayed when you enter this page and can be used in the calculations, or you can enter different values directly. If you choose to enter the GS on this page yourself, you do not have to enter any values on the TRI 0 page. There are 6 Lines of information.

- **Line 1:** Display to show the planned trip goes from your present position to a set position. The annunciation „S.POS“ listed on the right side of the line stands for „set position“, and indicates this is the TRI 2 page.
- **Line 2:** Displays the distance in nm (left side), and the direction in degrees magnetic north (right side), to the entered destination point.

- **Line 3:** Displays the GS in knots (left side), and the time enroute in an hr:min format, to the entered point.
- **Line 4:** Displays the user entered fuel flow rate in gallons per hour.
- **Line 5:** Displays the user entered amount of fuel to be used as a reserve in gallons. The amount of fuel in reserve is added to the amount required.
- **Line 6:** Displays the amount of fuel required for the trip in gallons.

To use this trip planning page:

1. Display the TRI 2 page on the left screen. Click on the LEFT CURSOR BUTTON and a rectangle will appear behind the first digit of the GS display on line 3.
2. Use the LEFT INNER KNOB to change the current value if desired. Use the LEFT OUTER KNOB to change cursor location, and then use the LEFT INNER KNOB to change the value. Repeat this process until all desired numbers have been entered.
3. Click on the LEFT CURSOR BUTTON to exit data entry. The unit will now display the ETE and fuel required for the trip based on the data entered.



MOD: Mode pages

The primary use of the mode pages is to switch navigation modes between LEG and OBS modes. In the LEG mode, the KLN 90B tracks the course laid out in the GPS flight plan, including automatic sequencing of wpts and Direct-To navigation. In the OBS mode, the KLN 90B interfaces with the EFIS and tracks the navigation type chosen with the EFIS. Another use of the mode pages is to change the CDI scale factor. Choices are 5, 1, and 0.2 nm to the left or right of the desired track, the default setting is 5 nm. This includes all CDI scales on the panel gauges. If a CDI scale has 5 markers, then the default scale value is 1 nm per mark. If the scale factor is set to 1 nm, then each mark is 0.2 nm, and if set to 0.2 nm, each mark is 0.04 nm. There are 2 mode pages, the LEG and the OBS pages, and the CDI scale factor can be set on either page. Both the LEG and OBS modes have a Direct-To function which allows the user to track directly to a destination. In the LEG mode tracking is to a wpt (discussed in the Direct-To section), and in the OBS mode it is to a station (MOD 2 section).

MODE 1: Mode 1 Page (MOD 1)



Fig 6.1

The mode 1 page is used to set the navigation type to the LEG mode. The mode 1 page is the default page, and the navigation type is automatically the LEG mode when on this page. Fig6.1 shows a sample of the MOD 1 page with the CDI scale set to +/- 5 nm. There are 3 Lines of information.

- **Line 1:** Indicates the LEG mode (MOD 1) is the active mode.
- **Line 2:** Indicates that it is the LEG mode that is the active mode.
- **Line 3:** Displays the user entered CDI scale factor. Choices include 5, 1, and 0.2 nm off the desired track.

To use this mode page:

1. Display the MOD 1 page on the left screen. Click on the LEFT CURSOR BUTTON and a long rectangle will appear behind the scale factor value on Line 3.
2. Use the LEFT INNER KNOB to toggle between the 3 choices.
3. Click on the LEFT CURSOR BUTTON to exit data entry. The unit will display the CDI scale factor entered and the scale will change on all CDIs.

MODE 2: Mode 2 Page (MOD 2)



Fig 6.2



Fig 6.3

The mode 2 page is used to set the navigation type to the OBS mode. The OBS is not set until the ENTER BUTTON is clicked. **Fig 6.2** shows an example of the MOD 2 page with the CDI scale set to +/- 5 nm and the OBS not yet activated. **Fig 6.3** shows an example of the MOD 2 page with the CDI scale set to +/- 0.2 nm and the OBS mode is activated. The OBS direction displayed on the middle line corresponds to the navigation type chosen with the EFIS. The choices are Nav1, Nav2, and ADF1; the active source is annunciated on the left side of the EFS 50. The ENR-LEG annunciation on Line 3 of the Super Nav 5 page will



change to annunciate the word OBS when in the OBS mode, and the ENR-LEG annunciation in the long rectangle at the bottom will change to ENR: xyz, where „xyz“ is the OBS heading to track in degrees magnetic north. There is also an OBS Direct-To feature available from this page. If the Direct-To BUTTON is clicked when in the OBS mode on the MOD 2 page, the aircraft will track directly to the signal in the heading displayed on Line 2, and will not respond to changes made using the COURSE SELECT KNOB. In the OBS Direct-To mode, the ENR: 123 annunciation will change to „D--> CRS 123“. There are 3 Lines of information.

- **Line 1:** Prompts the user to click on the ENTER BUTTON to activate the OBS mode. Also indicates when the OBS mode is active.
- **Line 2:** Indicates the OBS mode is the active mode, and displays the heading to the received signal in degrees magnetic north.
- **Line 3:** Displays the user entered CDI scale factor. Choices include 5, 1, and 0.2 nm off the desired track.

To use this mode page:

1. Display the MOD 2 page on the left screen. Click on the LEFT CURSOR BUTTON
2. and a long rectangle will appear behind the scale factor value on the bottom line.
3. Use the LEFT INNER KNOB to toggle between the 3 choices.
4. Click on the LEFT CURSOR BUTTON to exit data entry. The unit will display the
5. CDI scale factor entered and the scale will change on all CDIs.
6. Click on the ENTER BUTTON to activate the OBS mode.
7. Click 3 times on the DIRECT-TO BUTTON to enter the OBS Direct-To mode.
8. To exit the OBS Direct-To mode, go back to the MOD 1 page by clicking on the left side of the LEFT INNER KNOB (letter C).

FPL: Flight plan page



Fig 7.1

The flight plan page is used to display information specific to the active flight plan. This information includes a list of the wpts, numbered in numerical order, with an arrow to indicate the current active wpt. If an approach has been loaded, the FPL 0 page also displays the approach wpts and an arrow to show the active leg. The same information is displayed if the flight plan is Direct-To, except the starting location is not annunciated (see Line 1 in Fig 7.1). The data displayed on the FPL 0 page is information only, you cannot change any data on this page. All flight planning is done through the FS9 Flight Planner via the drop-down box (FLIGHTS-->Flight Planner). There is only 1 flight plan page, and the number of lines of information is variable.

- **Upper Lines:** The upper lines of the FPL 0 page identify the enroute wpt legs. The enroute wpt legs are distinguishable by listing a numerical value of each wpt according to their order in the active flight plan. The arrow indicates the current active flight plan leg.
- **Lower Lines:** The lower lines of the FPL 0 page identify the approach legs. The approach legs do not have a numerical value displayed with them, but they are listed in order of approach. The arrow indicates current active approach leg.



The FLP 0 page has a scrolling feature to enable viewing of all listed wpts. Click on the right cursor button when on the FPL 0 page and a rectangle appears behind the wpt listed on line 1. Use the RIGHT OUTER KNOB to scroll up and down through the wpts, the rectangle will move up and down accordingly. Note that this function will cause the current D/T page to be displayed on the right screen.

NAV: Navigation pages (right screen)

The right group navigation pages viewed on the right side screen contain all the same information as the left group navigation pages. The only differences are that with the right group pages you use the right buttons and knobs to enter data on the NAV 4 page for vertical navigation, the sequence and usage is the same. The other difference is that the RIGHT CURSOR BUTTON must be clicked in order to change the range factor of the moving map, which is done as before using the LEFT INNER KNOB. If the left NAV page is set to NAV 5, zooming on the right screen map will cause the NAV 1 page to be displayed on the left.

APT: Airport pages

The airport pages contain more information than any of the other Page Group pages. There are 8 airport pages that contain information about airport longitude and latitude, elevation, approach types available, runway lengths and directions, COM and NAV frequencies, and available services. The airport pages are also used to choose, load, and activate an approach. In addition, there are 9 nearest airport pages containing information such as longest runway length, direction to or from, and distance. The frequencies page, APT 4, is the default screen displayed when the unit is powered up, and lists the various frequencies of the current airport location for easy access.

APT 1: Airport 1 Page (APT 1)



Fig8.1

The airport 1 page displays information specific to the user entered airport listed on the top line. The user can enter the ICAO code for any airport in the data bank at any time regardless of the flight navigation status. Information includes the airport name, type, and latitude and longitude. There are 5 Lines of information.

- **Line 1:** Displays the user entered ICAO code of the airport desired.
- **Line 2:** Displays the chosen airport name.
- **Line 3:** Displays the chosen airport type. Choices include public, military, and private.



- **Line 4:** Displays the chosen airport latitude.
- **Line 5:** Displays the chosen airport longitude.

To use this airport page:

1. Display the APT 1 page on the right screen. Click the RIGHT INNER KNOB to the in position.
2. Click on the RIGHT CURSOR BUTTON and a blinking rectangle will appear behind the airport ICAO (or „---“) on Line 1.
3. Click on the right side of the RIGHT INNER KNOB (Letter H) to activate data entry. A blinking rectangle will now be present behind the first digit of the airport ICAO code name.
4. Use the RIGHT INNER KNOB, or keyboard, to enter the desired ICAO code.
5. Click the ENTER BUTTON twice to exit data entry and go back to the default screen.
6. Clicking on the CLR BUTTON at any time will exit the data entry mode without entering any newly added data.

APT 2: Airport 2 Page (APT 2)

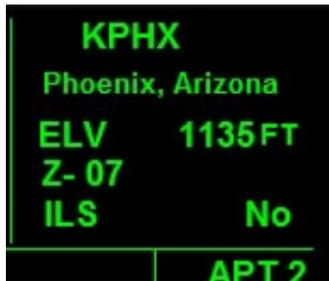


Fig 8.2

The airport 2 page displays the city name, elevation, hours relative to Zulu time, best approach type, and radar capability of the user entered airport. There are 5 Lines of information.

- **Line 1:** Displays the user entered ICAO code of the airport desired.
- **Line 2:** Displays the chosen airport city name.
- **Line 3:** Displays the chosen airport elevation in ft.
- **Line 4:** Displays the time offset relative to Zulu time.
- **Line 5:** The left side of the line displays the best approach type for the airport chosen. The right side of the line indicates if the chosen airport has radar capability. YES or NO is displayed.

To use this airport page:

1. Display the APT 2 page on the right screen. Click the RIGHT INNER KNOB to the in position.
2. Click on the RIGHT CURSOR BUTTON and a blinking rectangle will appear behind the airport ICAO (or „---“) on Line 1.
3. Click on the right side of the RIGHT INNER KNOB (Letter H) to activate data entry. A blinking rectangle will now be present behind the first digit of the airport ICAO code name.
4. Use the RIGHT INNER KNOB, or keyboard, to enter the desired ICAO code.
5. Click the ENTER BUTTON twice to exit data entry and go back to the default screen.
6. Clicking on the CLR BUTTON at any time will exit the data entry mode without entering any newly added data.



APT 3: Airport 3 Page (APT 3)



Fig 8.3



Fig 8.4

The airport 3 page is used to display runway information for the user selected airport. There are 2 screens of information. Fig. 8.3 shows an example of the default screen when you first open the APT 3 page, and Fig. 8.4 shows an example of the second screen. The default screen displays the runways of the selected airport in a north/south orientation. The name of the airport, its elevation, runway length, and Center frequency are also displayed on the screen. The second screen displays information about one specific runway at a time. The information includes specific runway information for the selected airport such as direction orientation, lighting, length, and surface type. The runways available at any selected airport can be viewed and selected for display from the second page via a popup window. The default screen displays the longest runway. The discussion immediately below refers to the information displayed on the second screen (Fig. 8.4).

- **Line 1:** Displays the airport identifier code.
- **Line 2:** The left side of this line displays the magnetic orientation of the runway in degrees magnetic north. The right side of the line displays runway lighting information. The choices and their annunciations are as follows:
 - o blank -no runway lighting
 - o L -lighting from sunset to sunrise
 - o LPC -lighting is pilot controlled
 - o LPT -lighting is part-time or on request

- **Line 3:** The left side of line 3 displays the runway length in ft. The right side displays the surface type of the runway. The choices and their annunciations are as follows:
 - HRD -hard surfaces (asphalt, concrete, tarmac, brick and bitumen)
 - TRF -turf
 - DRT -dirt
 - GRV -gravel
 - SND -sand
 - ICE -ice
 - MAT -steel matting
 - SHL -shale
 - SNW -snow
 - Blank -runway surface type unknown

To use this airport page:

1. Display the APT 3 page on the right screen. The first screen, or default screen, is displayed. Zoom in or out by clicking on the LEFT CURSOR BUTTON and then using the LEFT INNER KNOB to zoom in (letter J) or out (letter I).
2. Click the RIGHT INNER KNOB to the in position, and then click on its right side (letter H) to display the second screen.
3. Click on the RIGHT CURSOR BUTTON and a blinking rectangle will appear behind the airport ICAO (or „---“) on Line 1.
4. Click on the right side of the RIGHT INNER KNOB (Letter H) to activate data entry. A blinking rectangle will now be present behind the first digit of the airport ICAO code name.
5. Use the RIGHT INNER KNOB, or keyboard, to enter the desired ICAO code.
6. To view all runways present, click on the RIGHT OUTER KNOB to change the data entry field so the rectangle covers the runway orientation display (left side of Line 2).



7. Now click on the RIGHT INNER KNOB to view the popup screen, and then to scroll through the runways to choose one for display.
8. Click the ENTER BUTTON twice to exit data entry and go back to the second screen.
9. Click the left side of the RIGHT INNER KNOB (letter G) to go back to the default screen.
10. Clicking on the CLR BUTTON at any time will exit the data entry mode without entering any newly added data.

APT 4: Airport 4 Page (APT 4)



Fig.8.5

The airport 4 page is used to display communication frequencies for the selected airport. The KLN 90B displays the frequencies of the current airport on the airport 4 page at start-up so the user can obtain the needed information without changing data. Frequencies displayed include approach, ATIS, tower, ground, center, departure, clearance, UNICOM, FSS, and ILS frequencies. There are multiple Lines of information depending on the chosen airport.

- **Line 1:** Displays the user selected airport identifier code.
- **Lines 2...:** Multiple lines displaying the communications frequencies of the user selected airport. The frequency type is listed on the left side of the screen, and the corresponding frequencies are listed on the right.

To use this airport page:

1. Display the APT 4 page on the right screen to view the information.
2. To display information for a different airport, click the RIGHT INNER KNOB to the in position.
3. Click on the RIGHT CURSOR BUTTON and a blinking rectangle will appear behind the airport ICAO (or „----“) on Line 1.
4. Click on the right side of the RIGHT INNER KNOB (Letter H) to activate data entry. A blinking rectangle will now be present behind the first digit of the airport ICAO code name.
5. Use the RIGHT INNER KNOB, or keyboard, to enter the desired ICAO code.
6. Click 2 times on the ENTER BUTTON to exit data entry, or time to allow for scrolling through the different frequencies of the selected airport. If the ENTER BUTTON is clicked once; the rectangle behind the airport identifier will stop blinking.
7. Use the RIGHT OUTER KNOB to scroll through all frequencies available.
8. Use the CLR or ENTER BUTTON to exit scrolling. The rectangle will disappear.



APT 5: Airport 5 Page (APT 5)



Fig 8.6

The airport 5 page is currently UNAVAILABLE.

APT 6: Airport 6 Page (APT 6)



Fig 8.7

The airport 6 page is used to display the fuel services available at a user selected airport. The Lines of information depends on the fuel services available.

- **Line 1:** Displays the user selected airport ICAO identifier code.
- **Lines 2-:** Displays the fuel services available.

To use this airport page:

1. Display the APT 6 page on the left screen. Click the RIGHT INNER KNOB to the in position.

2. Click on the RIGHT CURSOR BUTTON and a blinking rectangle will appear behind the airport ICAO (or „---“) on Line 1.
3. Click on the right side of the RIGHT INNER KNOB (Letter H) to activate data entry. A blinking rectangle will now be present behind the first digit of the airport ICAO identifier.
4. Use the RIGHT INNER KNOB, or keyboard, to enter the desired ICAO code.
5. Click the ENTER BUTTON twice to exit data entry and go back to the default screen.
6. Clicking on the CLR BUTTON at any time will exit the data entry mode without entering any newly added data.

APT 7: Airport 7 Page (APT 7)



Fig 8.8

The airport 7 page is used to display SID/STAR procedures in real life. In FSX, except for Direct-To, all flight planning is done through the FSX Flight Planner pages. These pages are accessible through the drop down bar: Flights -> Flight Planner.



APT 8: Airport 8 Page (APT 8)



Fig 8.9



Fig 8.10

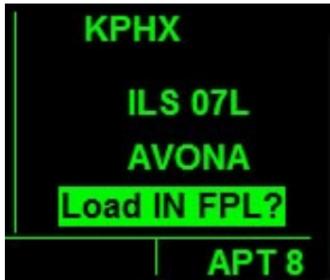


Fig 8.11

The airport 8 page is used to display non-precision approach information for the user selected airport. This is also the page to load and activate the entered approach. The user enters the desired airport identifier code, and then chooses the various approaches available for the selected airport. These changes will be shown on the FPL 0 page. There are 4 Lines of information.

- **Line 1:** Displays the user selected airport identifier.
- **Lines 2 and 3:** Displays the user selected approach procedures.
- **Line 4:** Display to indicate the approach choices can be entered into the flight plan. The line will display the word „ACTIVATE?” if the approach has been entered, and activation can begin.

To use this airport page:

1. Display the APT 8 page on the left screen. Click the RIGHT INNER KNOB to the in position.
2. Click on the RIGHT CURSOR BUTTON and a blinking rectangle will appear behind the airport ICAO (or „---“) on Line 1. Click on the right side of the RIGHT INNER KNOB (Letter H) to activate data entry. A blinking rectangle will now be present behind the first digit of the airport ICAO identifier.
3. Use the RIGHT INNER KNOB, or keyboard, to enter the desired ICAO code.
4. Click the ENTER BUTTON twice to exit data entry and go back to the default screen, or click once to allow for scrolling through the approach choices.
5. If the airport identifier has a rectangle behind it, clicking on the RIGHT OUTER KNOB will change data entry fields in the default screen. Clicking on the RIGHT INNER KNOB will bring up a popup screen listing the approach choices (**Fig 8.10**). Repeated clicks on the RIGHT INNER KNOB will scroll through the choices. Clicking on the ENTER BUTTON will enter the data into the flight plan.
6. Repeat the procedure listed in Line 6 until all information has been entered. When the ENTER BUTTON has been clicked to enter the last data, you are prompted to decide if you want to load the information into the flight plan (**Fig 8.11**). If you are ready, click the ENTER BUTTON again.
7. The chosen approach can be loaded or activated at any time by clicking the RIGHT
8. INNER KNOB to the in position, clicking on the RIGHT CURSOR BUTTON, and then clicking on the RIGHT OUTER KNOB until Line 4 is reached to display the prompt „Load in FPL?“ or „ACTIVATE“. Clicking on the ENTER BUTTON at this time will enter the choice.
9. Clicking on the CLR BUTTON at any time will exit the data entry mode without entering any newly added data.



NEAREST Airport Pages



Fig 8.12

The nearest airport pages display information about the 9 airports nearest to your current location in order of their nearness. An example of the nearest airport page 3 is presented in Fig8.12 showing the display format used on all 9 nearest airport pages. These pages are always updating so the airports and their order will always be current. The information on the nearest pages are „read only”, they cannot be changed directly by the user. There are 4 Lines of information.

- **Line 1:** The left side of Line 1 displays the airport identifier code. The right side displays the nearest airport page; shown as a boxed display. In Fig8.12 the box displays NR 3, indicating the viewed page contains information relating to the 3rd nearest airport to your current location.
- **Line 2:** Displays the length in ft of the longest runway at the user selected airport.
- **Line 3:** Displays the bearing to or from the airport from your current location in degrees magnetic north. To and FR annunciations on the right of the line shows if to or from the nearest airport.
- **Line 4:** Displays the distance in nm to the user selected airport.

To view the nearest airport pages:

1. Display the APT 1 page using the RIGHT OUTER and INNER KNOBS. Ensure the RIGHT INNER KNOB is in the out position.
2. Click on the left side of the RIGHT INNER KNOB (letter C) repeatedly to scroll down the nearest airport list. The list is scrolled upward by clicking on the right side of the RIGHT INNER KNOB (letter D).
3. Clicking on the right side of the RIGHT INNER KNOB when the NR 1 page is displayed takes you back to the APT 1 page.

VOR: VOR page



Fig 9.1

The VOR page provides the user with the ability to view information about any VOR in the data bank. The desired VOR is entered by the user and the KLN 90B displays the name, type, frequency, magnetic variation, and latitude and longitude of the VOR. There are 6 lines of information.

- **Line 1:** Displays the user entered VOR identifier.
- **Line 2:** Displays the VOR name.
- **Line 3:** Displays the VOR class. The annunciation meanings are listed below:
 - o T -Terminal
 - o L -Low altitude
 - o H -High altitude
 - o U -undefined



- **Line 4:** The left side of Line 4 displays the VOR frequency. The right side displays the magnetic variation in degrees.
- **Line 5:** Displays the VOR latitude.
- **Line 6:** Displays the VOR longitude.

To use this VOR page:

1. Display the VOR page on the right screen. Click the RIGHT INNER KNOB to the in position.
2. Click on the RIGHT CURSOR BUTTON and a blinking rectangle will appear behind the VOR identifier (or „---“) on Line 1.
3. Click on the right side of the RIGHT INNER KNOB (Letter H) to activate data entry. A blinking rectangle will now be present behind the first digit of the airport ICAO identifier.
4. Use the RIGHT INNER KNOB, or keyboard, to enter the desired ICAO code.
5. Click the ENTER BUTTON twice to exit data entry and go back to the default screen.
6. Clicking on the CLR BUTTON at any time will exit the data entry mode without entering any newly added data.

NEAREST VOR Pages



Fig 9.2

The nearest VOR pages display information about the 9 VORs nearest to your current location in order of their nearness. An example of the nearest VOR page 1 is presented in **Fig9.2** showing the display format used on all 9 nearest VOR pages. These pages are always updating so the VORs and their order will always be current. The information on the nearest pages are „read only“, they cannot be changed directly by the user. There are 4 Lines of information.

- **Line 1:** The left side of the line displays the VOR identifier, and the left side displays a boxed presentation of the nearest page number.
- **Line 2:** Displays the VOR class. Annunciation definitions are the same as on the primary VOR page.
- **Line 3:** The left side of this line displays the VOR frequency. The right side displays the VOR magnetic variation.
- **Line 4:** The left side of Line 4 displays the VOR frequency. The right side displays the magnetic variation in degrees, and shows if the station is „TO“ or „FROM“ your location.
- **Line 5:** Displays the VOR latitude.
- **Line 6:** Displays the VOR longitude.



To view the nearest VOR pages:

1. Display the VOR page using the RIGHT OUTER and INNER KNOBs. Ensure the RIGHT INNER KNOB is in the out position.
2. Click on the left side of the RIGHT INNER KNOB (letter C) repeatedly to scroll down the nearest VOR list. The list is scrolled upward by clicking on the right side of the RIGHT INNER KNOB (letter D).
3. Clicking on the right side of the RIGHT INNER KNOB when the NR 1 page is displayed takes you back to the VOR page.

NDB: NDB Page



Fig 10.1

The NDB page provides the user with the ability to view information about any NDB in the data bank. The desired NDB is entered by the user and the KLN 90B displays the name, type, frequency, magnetic variation, and latitude and longitude of the NDB. There are 5 lines of information.

- **Line 1:** Displays the user entered NDB identifier.
- **Line 2:** Displays the user entered NDB name.
- **Line 3:** Displays the frequency of the user selected NDB.
- **Line 4:** Displays the NDB latitude.
- **Line 5:** Displays the NDB longitude.

To use the NDB page:

1. Display the NDB page on the right screen. Click the RIGHT INNER KNOB to the in position.
2. Click on the RIGHT CURSOR BUTTON and a blinking rectangle will appear behind the NDB identifier (or „----“) on Line 1.
3. Click on the right side of the RIGHT INNER KNOB (Letter H) to activate data entry. A blinking rectangle will now be present behind the first digit of the airport ICAO identifier.
4. Use the RIGHT INNER KNOB, or keyboard, to enter the desired ICAO code.
5. Click the ENTER BUTTON twice to exit data entry and go back to the default screen.
6. Clicking on the CLR BUTTON at any time will exit the data entry mode without entering any newly added data.

NEAREST NDB Pages



Fig10.2

The nearest NDB pages display information about the 9 NDBs nearest to your current location in order of their nearness. An example of the nearest NDB page 2 is presented in Fig10.2 showing the display format used on all 9 nearest NDB pages. These pages are always updating so the NDBs and their order will always be current. The information on the nearest pages are „read only“, they cannot be changed directly by the user. There are 4 Lines of information.



- **Line 1:** The left side of the line displays the NDB identifier, and the right side displays a boxed presentation of the nearest page number.
- **Line 2:** Displays the frequency of the user selected NDB.
- **Line 3:** Displays the bearing to or from the selected NDB station in degrees magnetic north.
- **Line 4:** Displays the distance to or from the NDB station in nm.

To view the nearest NDB pages:

1. Display the NDB page using the RIGHT OUTER and INNER KNOBS. Ensure the RIGHT INNER KNOB is in the out position.
2. Click on the left side of the RIGHT INNER KNOB (letter C) repeatedly to scroll down the nearest airport list. The list is scrolled upward by clicking on the right side of the RIGHT INNER KNOB (letter D).
3. Clicking on the right side of the RIGHT INNER KNOB when the NR 1 page is displayed takes you back to the NDB1 page.

INT: Intersection page



Fig 11.1

The intersection page displays pertinent information about an intersection selected by the user. This includes low altitude, high altitude, approach, and SID and STAR intersections. It also includes outer marker and compass locators, and displays the radial and distance to or from the intersection. There are 6 lines of information.

- **Line 1:** Displays the intersection, outer marker, or outer compass locator name.
- **Line 2:** Displays the identifier code of the intersection, outer marker, or outer locator.
- **Line 3:** Displays the radial to or from the intersection, outer marker, or outer locator in degrees.
- **Line 4:** Displays the distance to the intersection, outer marker, or outer locator in nm.
- **Line 5:** Displays the latitude of the selected intersection.
- **Line 6:** Displays the longitude of the selected intersection.

To use the intersection page:

1. Display the intersection page on the right screen. Click the RIGHT INNER KNOB to the in position.
2. Click on the RIGHT CURSOR BUTTON and a blinking rectangle will appear behind the intersection name (or „---“) on Line 1.



3. Click on the right side of the RIGHT INNER KNOB (Letter H) to activate data entry. A blinking rectangle will now be present behind the first digit of the airport ICAO identifier.
4. Use the RIGHT INNER KNOB, or keyboard, to enter the desired ICAO code.
5. Click the ENTER BUTTON twice to exit data entry and go back to the default screen.
6. Clicking on the CLR BUTTON at any time will exit the data entry mode without entering any newly added data.

SUPL: Supplemental page (SUP)



Fig 12.1

Fig 12.1 shows the display format for the supplemental wpt page. Supplemental wpts are user defined wpts other than airport, VOR, or NDB wpts. Clicking on the RIGHT CURSOR BUTTON while on this page will direct you to the FS9 Flight Planning page.

CTR: Center WPT page



Fig 13.1



Fig 13.2

The center 1 page is used to add center wpts to a flight plan. Center wpts are wpts located at the intersection of a flight plan and the boundary of air traffic control centers or area control centers. Except for a Direct-To flight plan, all other flight planning is done on the FS9 / FSX Flight Planner page. The default screen is shown in **Fig 13.1**, and **Fig 13.2** shows the display when the FPL 0 page is opened.



REF: Reference WPT page



Fig14.1

The reference wpt page is used to add reference wpts to a flight plan. Reference wpts are wpts that lie on the „great circle“ route where the flight plan route passes closest to the selected point. All wpt entries, excepting Direct-To, are set on the FS9 Flight Planning page.

ACTV: Active WPT page (ACT)



Fig14.1

The active wpt page displays information specific to the next wpt of a flight plan. This page allows the user to view pertinent navigational information specific to the next active wpt, regardless of wpt type, without further user input. The next wpt can be of any type including airport, VOR, NDB, or intersection wpts. Fig14.1 shows a typical ACT

page (right screen). All of the information displayed on this screen will change to the next active wpt as each leg of the flight plan changes. This page contains 5 lines of information.

- **Line 1:** The number on the left side of the line is the sequential wpt number, and to the right of it is the wpt identifier of the next active wpt.
- **Line 2:** The left side of this line displays the distance to the next active wpt in nm. The right side displays the magnetic bearing to the next active wpt in degrees.
- **Line 3:** The left side of this line displays the time to the next active wpt with the current flight conditions. The format is hrs:min. The right side of the line shows the CourseTo Steer to the next active wpt in degrees magnetic north.
- **Line 4:** Displays the latitude of the next active wpt.
- **Line 5:** Displays the longitude of the next active wpt.

D/T: Distance/Time pages

As the name implies, the D/T pages provide information about the distance and time between active legs of a flight plan, and between any position on the flight plan to the destination wpt. Both the ETE and the ETA are displayed on these pages. There are 4 D/T pages. The D/T pages are designed to be viewed in conjunction with flight plan information, and as such the first 3 D/T pages are displayed in a different format when the FPL 0 page is open at the same time on the left screen. There is no data entry on the D/T pages.



D/T 1: DISTANCE/TIME 1 PAGE (D/T 1)

2	57AZ
DIS	18 NM
ETE	00:08
6	KFLG
DIS	185 NM
ETE	01:29
D/T 1	

Fig15.1

The distance/time 1 page is used to display the distance and time to the next active waypoint, and to the destination wpt. In addition, the wpt identifier and the sequential number of each wpt are listed for easy reference. **Fig15.1** shows an example of the default D/T 1 page. There are 6 lines of information.

- **Line 1:** The number on the left side of the line is the sequential wpt number, and to the right of it is the wpt identifier, of the next active wpt.
- **Line 2:** Displays the distance to the next active wpt in nm.
- **Line 3:** Displays the time to the next active wpt with the current flight conditions. The format is hrs:min.
- **Line 4:** The number on the left side of the line is the sequential wpt number, and to the right of it is the wpt identifier, of the destination wpt.
- **Line 5:** Displays the distance to the destination wpt in nm.
- **Line 6:** Displays the time to the destination wpt with the current flight conditions. The format is hrs:min.

D/T PAGE 1 WITH FLP 0:

L	1 : KDMA	DIS	ETE
2 :	57AZ	18	00:09
3 :	E81	68	00:33
4 :	51AZ	90	00:43
5 :	KPAN	130	01:02
6 :	KFLG	185	01:29

FPL 0 | D/T 1

Fig15.2

The format displayed on the D/T 1 page when the FPL 0 page is open simultaneously on the left screen is shown in Fig15.2. The distance and ETE information on the D/T 1 page is listed in order of the distance to the destination wpt, and corresponds to the order displayed on the FPL 0 page. The first line on the D/T 1 page with distance and ETE information will always correspond to the next active wpt leg and will be indicated by the arrow on the FPL 0 page; as you pass a wpt leg, the corresponding information displayed on the D/T 1 page will disappear. There are 2 columns of information.

- **Left Column:** Displays the distance to the corresponding wpt of the flight plan in nm.
- **Right Column:** Displays the ETE to the corresponding wpt of the flight plan in an hrs:min format.



D/T 2: Distance/Time 2 Page (D/T 2)



Fig15.3

The distance/time 2 page is used to display the distance and arrival time to the next active waypoint, and to the destination wpt. In addition, the wpt identifier and the sequential number of each wpt are listed for easy reference. **Fig15.3** shows an example of the default D/T 2 page. There are 6 lines of information.

- **Line 1:** The number on the left side of the line is the sequential wpt number, and to the right of it is the wpt identifier, of the next active wpt.
- **Line 2:** Displays the distance to the next active wpt in nm.
- **Line 3:** Displays the estimated arrival time to the next active wpt with the current flight conditions. The format is hrs:min.
- **Line 4:** The number on the left side of the line is the sequential wpt number, and to the right of it is the wpt identifier, of the destination wpt.
- **Line 5:** Displays the distance to the destination wpt in nm.
- **Line 6:** Displays the estimated arrival time to the destination wpt with the current flight conditions. The format is hrs:min.

D/T PAGE 2 WITH FLP 0:

L	1 : KDMA	DIS	ETA
+	2 : 57AZ	18	08:50
3 :	E81	68	00:33
4 :	51AZ	90	09:24
5 :	KPAN	130	09:43
6 :	KFLG	185	10:10

FPL 0 | D/T 2

Fig 15.4

The format displayed on the D/T 2 page when the FPL 0 page is open simultaneously on the left screen is shown in **Fig 15.4**. The distance and ETA information on the D/T 2 page is listed in order of the distance to the destination wpt, and corresponds to the order displayed on the FPL 0 page. The first line on the D/T 2 page with distance and ETA information will always correspond to the next active wpt leg and will be indicated by the arrow on the FPL 0 page; as you pass a wpt leg, the corresponding information displayed on the D/T 2 page will disappear. There are 2 columns of information.

- **Left Column:** Displays the distance to the corresponding wpt of the flight plan in nm.
- **Right Column:** Displays the ETA at the corresponding wpt of the flight plan in an hrs:min format.



D/T 3: Distance/Time 3 Page (D/T 3)

2	57AZ
DIS	18 NM
DTK	327 °
6	KFLG
DIS	185 NM
DTK	330 °
<hr/>	
	D/T 3

Fig15.5

The distance/time 3 page is used to display the distance and bearing to the next active waypoint, and to the destination wpt. In addition, the wpt identifier and the sequential number of each wpt are listed for easy reference. **Fig15.5** shows an example of the default D/T 3 page. There are 6 lines of information.

- **Line 1:** The number on the left side of the line is the sequential wpt number, and to the right of it is the wpt identifier, of the next active wpt.
- **Line 2:** Displays the distance to the next active wpt in nm.
- **Line 3:** Displays the bearing to the next active wpt with the current flight conditions.
- **Line 4:** The number on the left side of the line is the sequential wpt number, and to the right of it is the wpt identifier, of the destination wpt.
- **Line 5:** Displays the distance to the destination wpt in nm.
- **Line 6:** Displays the bearing to the destination wpt with the current flight conditions.

D/T PAGE 3 WITH FLP 0

L	1 : KDMA	DIS	DTK
2 :	57AZ	018	327
3 :	E81	068	341
4 :	51AZ	090	357
5 :	KPAN	130	327
6 :	KFLG	185	330

FPL 0 | D/T 3

Fig15.6

The format displayed on the D/T 3 page when the FPL 0 page is open simultaneously on the left screen is shown in Fig15.6. The distance and ETA information on the D/T 3 page is listed in order of the distance to the destination wpt, and corresponds to the order displayed on the FPL 0 page. The first line on the D/T 3 page with distance and bearing information will always correspond to the next active wpt leg and will be indicated by the arrow on the FPL 0 page; as you pass a wpt leg, the corresponding information displayed on the D/T 3 page will disappear. There are 2 columns of information.

- **Left Column:** Displays the distance to the corresponding wpt of the flight plan in nm.
- **Right Column:** Displays the bearing to the corresponding wpt of the flight plan in degrees magnetic north.



D/T 4: Distance/Time 4 Page (D/T 4)

KPHX	LMT
DEP	09:31
TIME	09:33
ETA	10:01
FLT	00:04
ETE	00:28
	D/T 4

Fig 15.7

The D/T 4 page displays time information regarding the entire flight to the destination wpt. This includes the time departing the initial airport, the local time, the flight time, the estimated time enroute to the destination wpt, and the time of arrival at the destination wpt. The time format is hrs:mins. There are 6 lines of information.

- **Line 1:** The left side of line 1 displays the destination wpt identifier. The right display indicates the times in the column below it are local mean times.
- **Line 2:** Displays the departure time from the initial airport. Departure time is taken as the time when the aircraft's GS reaches 30 knots.
- **Line 3:** Displays the local time.
- **Line 4:** Displays the estimated time of arrival at the destination wpt.
- **Line 5:** Displays the flight time. The time the flight timer starts is set on the SET 4 page. The choices are to start the timer when the unit is turned on (the default choice), or to start the timer when the GS reaches 30 knots.
- **Line 6:** Displays the estimated time enroute to the destination wpt.

Message page

The following discussion is about the functions associated with the message (MSG), altitude alert (ALT), and Direct-To (-D->) buttons.

MESSAGE PAGE: MSG Button



Fig 16.1

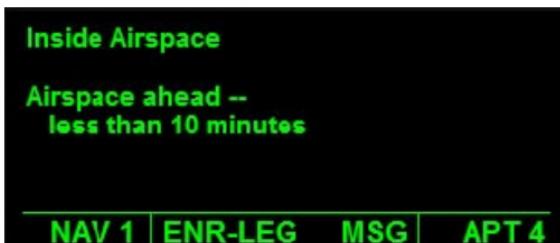


Fig 16.2

The message page is used to alert the pilot of a situation that may require their attention. When the KLN 90B has an alert message to be displayed, the letters „MSG“ will appear on the right side of the long rectangular box, just below the display screens, with a blinking rectangle behind it (**Fig 16.1**). Clicking on the MSG BUTTON at this time will display the alert message over the entire screen as shown in **Fig. 16.2**. Click the MSG BUTTON a second time to exit the message screen. To turn messaging off, click and hold the MSG BUTTON down for several seconds. No annunciation is displayed if messaging is turned off.

ALTITUDE ALERT PAGE: ALT Button

ALTITUDE	VNV	INACT
BARO : 29.90"	IND	12505FT
ALERT : OFF	SEL	03200FT
	KPHX	-00 NM
	ANGLE	-1.9°
CRSR ENR-LEG		CRSR

Fig17.1

ALTITUDE	VNV	INACT
BARO : 29.90"	IND	12505FT
ALERT : ON ->	SEL	03200FT
WARN : ± 000 FT	KPHX	-00 NM
	ANGLE	-1.9°
CRSR ENR-LEG		CRSR

Fig 17.2

ALTITUDE	VNV	INACT
BARO : 29.90"	IND	12505FT
ALERT : ON ->	SEL	03200FT
WARN : ± 400 FT	KPHX	-00 NM
	ANGLE	-1.9°
CRSR ENR-LEG		CRSR

Fig 17.3

The altitude alert page is used in conjunction with the SEL field of the NAV 4 page to alert the pilot when the aircraft has reached a specified number of feet above a pre-selected altitude. Clicking on the ALT BUTTON will display the altitude alert page on the left screen and the NAV 4 page on the right screen as shown in Fig17.1. The number of feet above the altitude is entered on the altitude alert page and the selected alert altitude is entered on the NAV 4 page. Only the SEL altitude field is used on the NAV 4 page, the rest are used in vertical

navigation. **Fig17.1** shows the default screen with both cursors on and rectangles highlighting data entry fields that are ready to be changed. The altitude alerting feature is also turned on and off on this page. The current barometric pressure is displayed when this page is opened (default), and if it is not changed will be used in altitude calculations. There are 4 lines of information on the altitude alert page.

- **Line 1:** Display showing the page viewed is the altitude alert page.
- **Line 2:** Displays the user entered barometric pressure in inches of Hg.
- **Line 3:** Displays the on/off status of the altitude alert feature. When turned on, the information on Line 4 is displayed.
- **Line 4:** Displays the user entered feet above the altitude, selected on the NAV 4 page, to be notified.

To use the altitude alert page:

1. Click on the ALT BUTTON to display the altitude alert page on the left screen and the NAV 4 page on the right screen.
2. Click on the LEFT CURSOR BUTTON and a rectangle will appear behind the first 2 digits of the barometric pressure on the altitude alert page and the left cursor will be on, indicating data is ready to be entered (Fig 17.1).
3. Use the LEFT INNER KNOB to change the first 2 digits to the desired barometric pressure.
4. Click on the LEFT OUTER KNOB to scroll to the next field. Again use the LEFT INNER KNOB to change the value. Repeat the steps again to enter the correct barometric pressure.
5. Click on the LEFT OUTER KNOB again to position the rectangle over the OFF/ON annunciation on Line 3 (Fig 17.2). Use the LEFT INNER KNOB to toggle between off and on; off is the default setting. If set to OFF, the information on Line 4 will not be displayed.



6. If the altitude alert feature is turned ON, click on the LEFT OUTER KNOB to position the rectangle over the number displayed on Line 4 (Fig17.3). Use the LEFT INNER KNOB to change the value.
7. To enter the selected altitude on the NAV 4 page, click on the RIGHT CURSOR BUTTON and then use the RIGHT INNER KNOB to enter the value.
8. Click on the ALT BUTTON to exit the altitude alert page at any time. The LEFT OUTER KNOB can be used to scroll forward or backward through the data entry fields.
9. When the number of feet above the selected altitude reaches 0, a large red „ALT ALERT“ annunciation will be displayed across both screens until the altitude alert feature is either turned off or reset.

Direct-To Page



Fig18.1

The Direct-To page is used to enter the Direct-To mode of navigation, whereby the aircraft will start to track directly to the wpt selected on this page. The Direct-To mode can be entered regardless of whether a flight plan was previously active or not. Simply click on the DIRECT-TO BUTTON, enter the identifier of the wpt you want to go to, and the KLN 90B will navigate you there. There is a Direct-To feature for the ENROUTE LEG and OBS modes. As discussed previously, the mode to be used is chosen on the Mode pages. To use the Direct-To page:

1. Click on the DIRECT-TO BUTTON and the Direct-To page will be displayed on the left screen (Fig18.1). A blinking rectangle highlights the wpt identifier field.
2. Click the RIGHT INNER KNOB to the in position and click once on the RIGHT INNER KNOB to activate data entry. A smaller, blinking rectangle appears behind the first data field to be changed at this time.
3. Use the RIGHT INNER and OUTER KNOBS, or your keyboard, to enter the desired wpt identifier.
4. Click the ENTER BUTTON 3 times to enter the data and begin tracking to the selected wpt. The Direct-To page will disappear and the original page will again be displayed on the left screen. The information on the FPL 0 page will change accordingly.